ON THE CARE AND MAINTENANCE OF IRON BRIDGES.*

DISCUSSION BY THEODORE COOPER, M. AM. SOC. C. E.

The rusting or corrosion of wrought iron at ordinary temperatures is a very important matter of consideration.

The example given by Mr. Macdonald† of the corrosion of an iron rod set in sulphur is not an uncommon one; numerous instances, however, can be given where iron set in sulphur has not corroded. The explanation, to the writer's mind, is a simple one. There is no chemical action between pure sulphur and iron at ordinary temperatures; these two elements only uniting at high temperatures—above red heat. But ordinary commercial sulphur generally contains sulphuric and sulphurous acids, produced by the oxidation of the sulphur during its process of sublimation. These acids are the immediate corroding agents when the impure sulphur and iron are in contact.

Such sulphur should be thoroughly washed before being used.

In general, the rusting or corrosion of iron only takes place in the presence of an acid and moisture.

In dry air at common temperatures, or under pure water free from air and carbonic acid, iron does not oxidize. Neither does it oxidize in dry carbonic acid gas; nor to any great extent, if at all, in damp oxygen. But in the presence of moisture and many acids the corrosion takes place readily and continuously.

The most common agent toward corrosion is carbonic acid gas.

Prof. Calvert found that damp air with a slight addition of carbonic acid produced a rapid oxidation; the process being, first a production of protoxide of iron, changing to the carbonate and then passing to the hydrated oxide or ordinary rust. Though the carbonic acid was the active agent in bringing about the combination, the carbonate of iron remained in small quantity—an apparent process of transfer or disposing influence.

As our atmosphere contains carbonic acid gas and aqueous vapor, and as all natural waters contain air and general carbonic acid in solution, the rusting of iron is universal. It varies, however, in the degree of rapidity according to the conditions of the special location; the dryness of the air in certain regions making the action an exceedingly slow one, while in others the excess of moisture and gaseous acids produce an exceedingly rapid corroding action. In tubular bridges, tunnels covered with iron girders, and the overhead parts of bridges, the iron work is especially subject to corrosion, due to the excessive amount of moisture (condensed steam), carbonic acid and frequently sulphurous acid discharged upon the exposed surfaces from the locomotives.

While the sulphurous acid, if present, is a very active agent in promoting corrosion, the greatest factor is undoubtedly the carbonic acid gas. An analysis of a sample of rust taken from the Conway Bridge gave

Sesquioxide of iron	93.094	per cent.
Protoxide "	5.810	"
Carbonate "	0.900	"
Silica.	0.196	"

Mr. Wm. Kent found in rust taken from a Pennsylvania Railroad bridge, where it was exposed to the action of the escaping gases, carbonic acid in considerable quantities, but only traces of sulphuric and sulphurous acids.

Under fresh or under salt water the corrosion of iron is largely influenced by the presence and amount of air and carbonic acid gas.

The action generally appears to be greater where the iron is alternately wet and dry.

The caustic alkalies and alkaline earths prevent the oxidation of iron by neutralizing the acids. Iron, therefore, does not corrode in alkaline solutions or when imbedded in lime.

The testimony in regard to the action of a thin coating of lime whitewash upon iron is contradictory. The writer has seen many cases where whitewash has corroded iron rapidly; others testify to its thorough preservative qualities. The difference may consist in the addition of other ingredients to the solution; for example, it is often customary for whitewashers to add common salt to the lime solution to increase the hardness of the coating; again, others add glue or similar material to the lime to increase its adhesive qualities. The one containing the salt would undoubtedly corrode the iron, and the other with the glue would not do so. Whether a thin layer of lime only, after the lime had taken up its full equivalent of carbonic acid, would continue to act as a preservative, is doubtful; for from its hydroscopic character it would readily convey moisture charged with the destructive acid in to the surfaces of the metal.

As to hydraulic cement, the evidence is not so positive. Mr. Thos. C. Clarke, M. Am. Soc. C. E., says, in his report upon the Niagara Bridge, that on uncovering the anchorage links he found the iron as perfect as when put there, without the slightest sign of rust, though the mortar was saturated with moisture and the whole foundation evidently surrounded by water-bearing strata of rock. Gen. M. C. Meigs says he found a wrought-iron pipe laid in cement concrete honeycombed and leaky after twelve years' time, and he learns from plumbers that in their experience American cements corrode iron.

This different testimony in regard to the action of cements may possibly be explained by the different circumstances of each case—such as the relative compactness and depth of the cement in which the iron is imbedded.

There is a possibility, however, that in certain cements the silicates may be soluble in water, and thus furnish the acid agent toward corrosion. Mineral wool made from furnace slag very closely approximating the composition of hydraulic cements has been found in certain cases to corrode iron very rapidly. It was claimed that this was entirely due to the hygroscopic character of this material, but recent instances reported to me would appear to lead to the belief that the wool in the presence of water not only corrodes the iron, but also disintegrates and hardens into a solid mass.

Wet coal ashes corrode iron very rapidly.

Mr. Wm. Metcalfe, M. Am. Soc. C. E., states that a wrought iron pipe buried in coal ashes was completely eaten away in one year's time.

As a curious instance of the slight causes which promote oxidation, the experience of a manufacturer of fine cutlery was related to me. He found at one time a large portion of his goods being returned to him as in damaged condition; instead of the bright clean surfaces for which such articles are noted, he found rusty, deeply oxidized blades. After much anxiety and watching to determine the cause, whether it was damp paper, the ill-will of some of his agents, or other cause, it was located upon the man who sorted and wrapped the knives into packages. Everything he touched was found to rust, from the peculiar acid character of his skin exhalations.

Similarly, it is well known that some persons cannot carry pocket knives or bright iron articles, as keys, etc., about their person without their becoming very rusty.

The rusting of iron proceeds with great rapidity after it has once commenced, because the rust of iron is a ready absorber of moisture and gases, and it thus constantly conveys new elements of destruction into the yet unchanged metal.

It is to this fact that the great difference in the rusting of used and unused rails, machinery and tools is due. The jars and vibrations to which the one is subjected keep the surfaces clear of accumulated rust, that would act as storage reservoirs for the corroding elements.

There is often much misconception in regard to the amount of iron contained in a certain thickness of rust. Dense, compact rust may contain enough iron to equal $\frac{1}{7}$ or $\frac{1}{8}$ of its thickness, but the looser and more common kind of rust will not contain over $\frac{1}{4}$ of its thickness in pure iron. In other words, rust $\frac{1}{4}$ inch in thickness will contain from $\frac{1}{16}$ to $\frac{1}{32}$ inch of iron, according to the density of the rust.

The preservation of iron from corrosion is a subject of vast importance, and has given rise to many expedients more or less effective, such as alloying iron with other metals, as chromium, tin, copper, arsenic, etc., to obtain a less corrodible metal; plating the surfaces with other less oxidizable metals, as nickel, tin, copper, silver or gold; coating with zinc, a metal that is readily oxidized upon the surface, but whose oxide, when formed, becomes a protection to any further oxidation (when not subject to other acids than carbonic acid gas); coating with fused mineral enamels; covering with lacquers; coating with magnetic oxide of iron by the processes of Bariff or Bower, by subjecting to high temperatures and the presence of moisture; and lastly the use of paints of innumerable characters.

For general engineering structures, the coating given to iron surfaces for their protection against corrosion must be not only moderate in cost, but of such a character as to be readily renewed when removed by accident or design. It must also differ from zinc in being able to resist the corroding action of sulphurous acid gas and the chlorides, in locations where these may occur.

This practically reduces us to the use of paints (using this term to include not only the paints proper, but varnishes, oils and other materials applied in a liquid form). The relative merits of the paints depend upon their durability, adhesiveness and imperviousness. The cracking of the paint and want of adhesion produced by too rapid drying of the paint, and the want of adhesion due to the presence of rust upon the surfaces of the iron, are the most frequent causes of failure in the better classes of paints. All rust should be carefully removed from the surfaces of the iron before painting; a coat of raw linseed oil then makes an excellent covering for the surface, elastic, perfectly adherent, and a good durable substratum for future coverings. In order to get our iron work out of the shops quickly and in a condition to be handled, we resort too often to quick-drying paints, to the future injury of the work.

As to the pigment to be used for the covering of this substratum, red lead, oxide of iron, etc., each have their own advocates.

The maintenance of iron bridges is so dependent upon the detail of their design, and the method and character of the inspection, that it is very important, both from points of economy and of safety, that the supervision of these points should be given to competent men.

The original design affects the maintenance and care of our bridges, not only by the form and proportions of the structure and its details as to strength, but also as it affects the accessibility for cleaning and painting, the freedom from lodgment of water and dirt, the amount of surface exposed to corrosion, the number of parts subject to adjustment, and the facility of repair and renewal of the ties or wooden floor.

The writer has seen bridges recently constructed, and which have been accepted by engineers of an important railroad, that have their wooden floors built into the iron work in such a manner that a broken or decayed tie cannot be replaced except by removing the whole bridge floor.

The inspection of bridges should be something more than the superficial examination of the track-walker. To know that every member is doing its duty properly, and to discover the reason when such is not the case and the remedy to be applied, requires the supervision of a more intelligent class of men than usually are delegated to this work.

Of hundreds of bridges examined during past years by the writer, it would be safe to say that not more than ten per cent. of them were found in a condition to do their best duty; many were badly neglected, and some positively dangerous, all showing a positive want of intelligent inspection and supervision. It would undoubtedly be true economy, and certainly a just duty to the public, for every railroad to have its bridges carefully and intelligently examined at least once a year by a special expert. If it accomplished no other end than to check and educate the ordinary local inspectors in a proper execution of their duties, it would pay for the expense.

*Read by Henry D. Blunden, M. Am. Soc. C. E., before the American Society of Civil Engineers, Oct. 18, 1882, and published in the Transactions of the Society, December, 1882.

†In a verbal discussion of the paper on the care and maintenance of bridges.

ENGINEERS' SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

Meeting of April 4, 1883.

The society met at 8 P. M., Director George S. Greene, Jr., in the Chair; John Bogart, Secretary. The following candidates were elected:—As Members—Thomas Appleton, Council Grove, Kan.; O. H. P. Cornell, Schenectady, N. Y.; G. H. Elliot, Norfolk, Va.; Orville Grove, Houston, Tex.; W. G. Williamson, Martinsville, Va. As Juniors—F. L. Fuller, Boston, Mass.; H. McDonald, Nashville, Tenn.

The preliminary arrangements for the Convention were reported by the Secretary. The Convention is to be held at the cities of St. Paul and Minneapolis, Minn. The party will arrive at St. Paul about noon on June 19. Full details will soon be announced. It is intended also to arrange for a visit to the National Exposition of railway appliances, at Chicago, before proceeding to St. Paul. The death of Mr. Peter Cooper on the morning of the meeting was announced, and after remarks by Mr. Macdonald, it was ordered that an appropriate notice should be spread upon the minutes of the society. A paper by G. Y. Wisner, M. Am. Soc. C. E., on Geodetic Field Work was read by the secretary in the absence of the author, and was discussed by Messrs. Haight, Prindle, Croes, and Geo. S. Greene, Jr.

ENGINEERS' CLUB OF PHILADELPHIA.

Rooms No. 1523 *Chestnut Street, Philadelphia, Pa.*

RECORD OF REGULAR MEETING, MARCH 17, 1883.

President Henry G. Morris in the chair; twenty-four members and one visitor present. Mr. Chas. A. Ashburner read a paper on "A New Method of Estimating the Contents of Highly Plicated Coal Beds as Applied to the Anthracite Fields of Pennsylvania." The questions of the future production and ultimate exhaustion of these fields are of the greatest importance. In 1860 the population of the United States was 31,443,321, and 8,513,123 tons of coal were produced, *i. e.*, actually shipped to market; in 1870 the population had increased 23 per cent. (38,558,371), and the production of anthracite was nearly doubled, being 16,182,191 tons. For the year 1880, with a population of over fifty millions, the product was 23,487,242 + tons. In 1882 the actual production was over 30,000,000 tons. It has been variously estimated that the 470 square miles containing this coal in Pennsylvania will be entirely exhausted in from 140 to 204 years. While Mr. Ashburner does not estimate

the ultimate exhaustion, he has devised a method for estimating the contents of these fields, from data now being obtained by the careful and practical geological and mining examinations of the State Survey. The exact position and detailed structural shape of the coal beds are first mapped by 50 feet contour lines along the floor of the beds, giving, completely and satisfactorily, their geometrical construction and shape. These surfaces are then developed into planes, by the development into straight lines of the line of the bed as cut by parralleled section planes 1,600 feet apart. This graphical method is attended with errors which are mathematically discussed, and which have been formulated by Mr. Arthur Winslow, Member of the Club. This method does not give the true area of the surface of a sphere, cone or triangular trough. In the case of a sphere, it gives $\frac{\pi}{4}$ of the true area; in a cone, the error increases directly as the secant of the angle which the pitch of the cone makes with its axis; and in a triangular trough, which more nearly represents the shape of the anthracite basins, the error is very much less. A practical test has been made of this method in the Panther Creek basin, between Mauch Chunk and Tamaqua, and the maximum possible error in estimating the surface area of the coal beds was found to be .905 of 1 per cent. After the areas are thus found, the contents are obtained by careful measurements made in the mines to ascertain the actual number of tons of coal which are contained in a unit (1 acre) of bed area. In this way it has been estimated that the above basin originally contained 1,082,000,000 ± tons; that the area under development originally contained 92,000,000 ± tons, out of which latter area 54,000,000 ± tons have been taken.

The Secretary presented, for Mr. John Marston, an illustrated set of formulæ for railroad turnouts and crossings.

Mr. John T. Boyd exhibited ribbons of phosphor-bronze with which he had experimented with a view to its use for tape lines, in mine, shop and other work, where the danger of breaking the ordinary steel lines is very great, and where the contact of the tape with substances in themselves injurious to it renders frequent wiping, and consequent scouring off of the figures, necessary. The phosphor-bronze ribbon was found to be extremely tough, but, in addition to the difficulty in its manufacture into this shape, it was found that after it was bent at a sharp angle, it would not straighen out, thus decreasing the length of the line. As using the hammer to straighten it would increase the length, the experiment was not prosecuted further.

The Secretary presented a system of reduction tables which he had made to facilitate long and tedious multiplications and divisions.

HOWARD MURPHY, Secretary and Treasurer.

LIVERPOOL ENGINEERING SOCIETY.

The sixth meeting of the society was held on Wednesday the 28th of March, at the Royal Institution, Colquitt Street, Mr. W. E. Mills in the chair, when a paper entitled "Notes on American Locomotives" was read by Mr. W. H. Fleming. The author commenced his paper, after a few preliminary remarks, with a short sketch of the early locomotives of the United States, and then went on to describe how the Americans had perfected the three great classes of engines, C. D. and E.—class C being for passenger service and for level lines and where the gradients are easy. Class D, known as the "Mogul" for goods and for heavy gradients. Class E, known as the "Consolidation" for roads having exceptionally heavy gradients or a very large traffic to be hauled, and gave a description of each, with their principal dimensions. He drew attention to the fact that American locomotives cost less than English although the prices of material are relatively high in the United States. There are several causes which combine to reduce the total cost of materials employed. A larger amount of cast iron finds a place in an American than in an English locomotive, also steel tubes and fire-boxes. The driving-wheel bodies are of cast-iron, while the truck wheels are altogether of that material. In the details he mentioned that one of the peculiarities in American locomotive construction is the framing, which is made of square bar-iron welded together, slotted, planned all over and entirely finished. The bar frames, besides being very rigid in every direction, admit of easy access to the link motion. They form at the same time a good base for attaching the various brackets and girder plates. Before concluding his paper he gave, as an illustration of what American locomotives have done and are capable of doing, the fast train that was run from New York to San Francisco in June, 1876, a distance of 3,317 miles in 83 hours 27 minutes, including stops. This is very close to 40 miles an hour and has never been approached by any other railway run ever made. Also some exceedingly heavy freight trains that had been hauled by a "consolidation" engine manufactured at the Baldwin Locomotive Works. The paper was illustrated by a number of photographs that Mr. Fleming had collected during his connection with the Brooks Locomotive Works, Dunkirk, New York State.

FRAUD IN BUILDING.

"There are blocks of buildings in New York that would be pulled down if the present building laws were applied to them," a veteran builder said. "There are other blocks that have been erected in the very cheapest manner and on the very verge of unlawful methods, that will have only an ephemeral existence. They have been put up under constant protest from the Department of Buildings, and in some cases by sharp watching for opportunities when inspectors were not within sight, they have been built in direct violation of law. It is an easy thing to get ready for laying the beams of a house and then seize a chance to slip them into the walls without particular regard to where they strike the flues. In the case of a recent fire in an apartment house up town it was discovered that one of the beams of the house had its end directly in the flue of the furnace. It had been charring for more than a year, and when the fire broke out it was so concealed as to baffle those who were looking for the cause.

"Speculative building is the curse of the city today. While on the one hand we have some of the most solid and perfectly built houses in the world—houses that will last for ages—there are very many that are toppling shells and tinder boxes. These houses are put up merely for show. They have all the deceptions that can possibly be devised to make a house appear what it is not. Wherever a penny can be saved it is saved. In every place out of sight the work is slighted. The fraud begins with the foundations. Instead of getting large flat stones, put well down into the ground, the speculative builder gets the cast-off material of the stone yard, and throws it together in the most unworkmanlike way. The mortar is poor stuff, sometimes made from the slacked lime of the gas-house, with all the strength out of it. The workmen are urged only to hurry. No time is given to make the work plumb and true. No care is permitted to let the work get firm and hard as it progresses. All is rush and hurry, and about all the safeguards that make a wall safe are neglected. The beams are the cast-off of the lumber yards, knotty, crooked; as light as the law will permit, and a trifle lighter. They are carelessly set. Nothing is square. The floors are put down in a hurry. Instead of nailing each tier of flooring there are three tiers put in, and the fewest possible number of nails to fasten them. The partitions are set up awry, and there is not a square room to be found. The walls and ceilings are models of the plasterer's ability to cheat, and the plumbing is a succession of monstrosities calculated to deal death in every bedroom.

"Even where contracts have been made calling for first-class materials, the skin builders manage to cheat in marvelous ways. Bronze locks are sometimes called for in a contract, but the speculative builder puts in a bronzed lock instead—that is, a lock that costs about one-fifth the money. Often in houses intended to be first-class, it is a common thing to find that, instead of cast brass hand-finished locks, that are called for by contract, the builder has substituted convict-made rolled brass locks, with iron pins, that rust out in a short time. In a number of cases some of these speculative buildings have been blown down by storms before they could be finished. In other instances the Inspector of Buildings has compelled the builders to tear them down and erect them according to law. That is the reason why there is so much opposition to the building laws. The speculative builders wish to put up dwellings in defiance of the laws of health, without safety from crumbling to pieces, and with no regard for ventilation or escape in case of fire.

"A real estate agent told me that since the fire in the Cambridge flats he has known of many persons giving up their apartments in upper stories, and he says there is no adequate number of new tenants to fill their places. A friend of mine recently bought one of those cheap houses, which had been built on speculation. He found poor veneers where he had supposed the wood was solid. He tried to hang a chandelier in the parlor, and found that there was only a small piece of gas pipe stuck in the ceiling, with no connection to any supply pipe—in fact a mere sham. The bracket burners on the walls were the same. A ventilating pipe, presumed to be of solid iron was found to be of sheet iron as thin as a wafer. The window sills were of boxed boards, the flooring of poor stuff, the window weights of brick, and everywhere was sham. From the moment he began to occupy the house the bad work was visible. Everything settled. The outer walls had cracks from window to window. The inner walls had seams that told where the outer walls had settled. Hardly a door in the house would shut, because the door frames were forced askew. When the doors were sliced off to permit them to close, great fissures were left where the doors had ceased to fit. The windows could not be raised until they had been trimmed so that at some points they rattled like dice in a box, although at others they stuck fast. The heating was found to be impossible without filling the house with coal gas. There was not a tight joint in the plumbing. Putty was used instead of solder, and covered over with stove blacking to hide the fraud."—*N. Y. Sun.*

THE RAILROAD EXPOSITION.

An exposition of great interest to the public will open in Chicago on May 24 and last for a month. The huge inter-State buildings by the shore of Lake Michigan will contain the most extensive and complete collection of railway appliances ever made. The present state of the art of running railroads in its highest development in America will be seen to perfection, and can be studied to advantage. Every visible thing pertaining to a railroad and its equipment will be displayed, from the mightiest locomotive engine built by man to the latest and best style of baggage check. It promises to be a wonderful show.

Peter Cooper was already thirty-five years old when the first iron-plated wooden rail was laid in America, and he was nearly forty when his locomotive, drawing a passenger car, made eighteen miles an hour on the trip from Baltimore to Ellicott's Mills. He lived to see about 110,000 miles of railroad in actual operation in this country, representing an investment of nearly six thousand million dollars, and giving direct and continuous employment to half a million men. This is the progress of fifty years; the mehanical results will be summed up at Chicago.

A list of the industries concerned in equipping the American railroad of to-day would be imposing in length and astonishing in its variety. The premiums offered at this exhibition are distributed under about four hundred and fifty different heads. There will be gathered together locomotives of every description, cars of twenty-one different classes, from the sumptuous hotel car to the flat gondola and the oil tank on trucks, running gear, interior furnishings and decorations, special machinery for the manufacture of everything in wood or iron that belongs to a railroad, steel and iron rails and track goods of all kinds, switches and station appurtenances, the electric head lamp that lights the way at night, the railroad cooking range, the hat hook, the conductor's punch, and the snow plough—every minor device that contributes to the safety, speed and convenience of travel. And there is also a department for the street railways.

We learn from the *Railroad Gazette* that both the Master Mechanics' and Master Car Builders' Associations have decided to hold their annual conventions in Chicago while the exposition is open. This is not surprising, for in its technical aspects the show will be of vast importance to all practical railroad men. The last census enumerated the railway employés of the United States in 1880 as follows:

Locomotive engineers	18,977
Conductors	12,419
Brakemen and other trainmen	48,254
Stationmen	63,380
General officers and clerks	12,030
Machinists and carpenters	45,968
Other employés in the shops	43,746
Trackmen	122,489
All other employés	51,694
Total	418,957

That was equivalent to about one-thirtieth of all the males twenty-one years of age and over in the United States. With the families dependent on them for support, the railroad employés of the country would make a community far more populous than New York City. They drew from the railroad companies in the year ending June 30, 1880, about $200,000,000 in wages. The figures refer only to those who are immediately employed in the operation of the railroads. To get an idea of the number of people who have a direct technical interest in the Chicago exposition, we should have to go to the statistics of the allied and subsidiary industries which equip and supply the railroads.

But interest in the Railroad Exposition will not be confined to railroad men. Everybody travels by rail, and everybody is personally concerned with the safety, convenience, comfort and even the artistic beauty of the means of travel. People, as a rule, are proud to believe that we lead the world in the ingenuity and variety of our railway appliances. The locomotive engine has come to be an accepted type of American business energy and mechanical skill. The Chicago show will probably attract more visitors than anything of the sort since the Centennial Exposition. How it would have astonished George Stephenson!—*N. Y. Sun.*

THE CHANNEL TUNNEL.—The two ends of the channel tunnel between France and England come about 120 ft. nearer each other every 24 hours.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 159.)

DXXI.—JOHNSTOWN, PA.

Johnstown, Pennsylvania, in lat. 40° 20′, N. long. 78° 53′ W., is at the foot of the Alleghany Mountains, on hilly ground on the Conemaugh River.

It was incorporated about 1800.

Water-works were built in 1867 by a private company, taking the supply by gravity from a number of small streams which take their rise on the west slope of the Alleghany Mountains. The works are now supplied from Wild Cat and Laurel runs and the Conemaugh and St. Clair rivers. Wild Cat and Laurel runs are impounded by clay dams 19 ft. high, forming reservoirs of 5,500,000 gallons capacity, 165 ft. above the city, to which the water is conveyed through 5 miles of 16-in. cast-iron pipe, the Wild Cat water being led to the main through 1,400 ft. of 10-in. pipe. The St. Clair storage reservoir has an earth dam 20 ft. high with puddle wall and rip-rap slope, and holds 25,000,000 gallons at 175 ft. above the city. The water is conveyed 3 miles through a 12-in. cast-iron pipe to a junction with the Laurel Run main. The Conemaugh reservoir, holding 6,000,000 gallons at 154 ft. above the city, is formed by a dam 6 ft. high of timber cribs filled with stone and planked over.

The water is conveyed five miles through a 20-in. cast-iron main.

The ordinary pressure in the city is 60 lbs.

Distribution is by cast-iron pipe of from 20 to 2 in. diameter. The length is not given.

There are 70 fire hydrants, 114 gates and 2,100 taps. The city pays $500 for each hydrant erected, the supply to be perpetual.

The service pipes are of lead.

The population in 1880 was 8,380. The daily consumption is not given.

The works have cost $379,341. No financial statistics are given.

D. J. Morrell is the President and James Williams the Superintendent.

DXXII.—SANTA FE, N. M.

Santa Fé, New Mexico, in lat. 35° 41 N., long. 105° 46′ 36″ W., is on Santa Fé River, 7,044 feet above the sea. It had been settled by the Indians long before its occupation by the Spaniards in 1560. In 1680 it was reoccupied by the Indians and held by them fourteen years. In 1846 it was occupied by United States troops, and the territorial government was organized in 1851.

Water-works were built by a private company in 1881 after plans of J. R. Barbour, taking the supply from Santa Fé River, which rises in the Rocky Mountains. A stone masonry dam, 45 ft. wide at the base and 10 ft. at top, creates a storage reservoir holding 30,000,000 gallons, 3¼ miles from and 345 ft. above the town. A second reservoir is now in course of construction. The water is conveyed to the town in a 10-in. cast-iron main. Distribution is by 8 miles of cast-iron pipe of 6 to 3 in. diameter, with 10 fire hydrants and 24 gates. The town pays $100 per year for each hydrant. Service pipes are of galvanized iron and lead.

The population in 1880 was 6,635. The daily consumption is not given.

The works have cost $175,000. The bonded debt is $110,000 at 6 per cent. interest. The works went into operation in 1882.

O. A. Meysenburg is Secretary, and William Moran the Superintendent.

(TO BE CONTINUED.)

The receipt of statistics as follows is acknowledged with thanks:

From James M. Frank, Jr., statistics of Johnstown, Pa., water-works.

From O. W. Mysenburg, Secretary, statistics of Santa Fé, N. M., water-works.

CORRECTIONS.—Hon. H. D. Campbell, proprietor of the Traverse City, Mich., water-works, completes the description of those works, as given in issue of *March* 3, *p.* 101 (No. 494). The works cost $17,000. There is no bonded debt. The cost of operation is $2,200 annually. The daily consumption is 60,000 gallons. The city pays $[illegible]00 per year for each fire hydrant. Service pipes are of galvanized iron. The gross income for 1882 was $4,500. The proprietor has an exclusive contract for lay-water-pipe and furnishing water in the city for twenty years. There are now 2½ miles of pipe laid, and in April and May 1½ miles is to be laid, with 12 fire hydrants.

FATAL BLASTING EXPERIMENT—LEBANON, Penn., April 12.—W. A. Le Row and Augustus Everhard, representing the Rend-Rock Powder Company of New York, were killed at Cornwall to-day while making a trial blast of rend-rock powder. They were charging the hole and used an iron bar to tamp it, which caused a premature explosion. Both were horribly mangled, their skulls being crushed. Everhard, who appears to have been stooping over the hole, was killed instantly. Le Row died half an hour after the explosion.

BELLOWS FALLS (VT.) WATER-WORKS.—The eleventh annual report of the Water Commissioner of the Bellows Falls village corporation is the most complete one ever issued. The report, which is printed by Little & Co., consists of 20 pages. The receipts of the Water Department up to Jan. 1, 1883, were $35,033, beginning with $1,609 in 1872, and amounting to $4,570 in 1882. The bonds issued foot up $68,900; interest, $25,227. The least depth of water in the river for three years was Jan. 31, 1881, three inches, and the greatest April 22, 1882, eight feet three inches. The number of families, etc., supplied with water was 508. Geo. A. Babbitt was elected Water Commissioner for three years, on Monday last.

AGAINST A TELEPHONE COMPANY.—HARTFORD, Conn., April 11.—An important case involving the rights of telephone companies and individuals was decided in the Superior Court to-day. The Southern New England Telephone Company got permission to place its wires temporarily on a business block owned by George Robinson. The company originally asked for a few days only, but Mr. Robinson gave it permission to keep its wires on the building for two weeks. The company afterward wished to occupy the building for a longer time, but Mr. Robinson objected and gave notice that the wires must be removed. The notice was disregarded, and Mr. Robinson cut the wires. The company thereupon sued him for $3,000 damages. Judge Andrews charged the jury that the defendant had the right of control over his own premises, and, the company failing to remove the wires after reasonable notice, had the right to remove the wires himself. The jury rendered a verdict against the company.

FORT WORTH (TEX.) WATER-WORKS.—Water will be turned into the distribution pipe to-morrow, Sunday.

NATIONAL RAILWAY EXPOSITION ITEMS.

Several papers, both in the East and West, have erroneously published March 24 as the opening day of the National Exposition of Railway Appliances.

The right date is *May* 24 and newspapers throughout the country are requested to aid in correcting this error by calling attention to it. Already a number of persons have taken long journeys to Chicago, expecting to be present at the opening, and in several places excursions have been prematurely organized as a consequence.

Everything will be in readiness on May 24, for the opening of this, the most unique, interesting and (except the Centennial) the largest exposition ever held on this continent. But to have everything in place on that day will tax the energies of the executive committee to the utmost. Some weeks since it was decided to make such additions to the International State Exposition building as would increase its floor capacity by about 200,000 feet. And now the plans have been changed still further to increase this amount by 100,000 feet, making an addition of 300,000 feet in all. This immense extension is found to be absolutely necessary to accommodate the exhibitors who have already applied for space.

The enterprise has become colossal, and it will be by far the most significant, attractive, and largely-attended attraction of the coming summer.

MOVABLE WEIR ON THE RIVER RHONE.

The River Rhone, geographically the principal watercourse of the southwest of France, offers very considerable difficulties to navigation in consequence of its great fall. Above Lyons it is navigable for only very small craft, but after its junction at Lyons with the Saône, the river becomes of important dimensions. Unfortunately, however, it varies considerably and rapidly in its conditions; it falls between Lyons and Arles, a distance of 174 miles, about 3 ft. per mile, while locally this fall is often doubled for a distance of one mile or more, forming rapids which offer great obstacles to navigation. Below Arles, however, the river bed is comparatively level. Windlasses worked by horses were employed previously to 1855, for towing barges up stream, but since the introduction of steamboats, some river paddle steamers, called "grappins," were built, provided with a heavy iron wheel of about 20 ft. in diameter, the cast iron arms of which extended about 18 in. beyond the rim of the wheel. In places where these steamers could not work up river by means of their paddles only, this grappling wheel, arranged in a longitudinal slot in the center line of the steamer, was lowered to the river bed, and being driven by chain gear, propelled the vessel by imbedding the arms on its circumference in the shingle forming the river bottom. These steamers were used as tug-boats, and they worked very satisfactorily, having but 10 per cent. of slip on the circumference of the wheel, but they naturally required great driving power, and at times the water level sunk to less than 24 in., making navigation quite impossible.

That with so heavy a fall, considerably greater than that of the Rhine at its most unfavorable position near Bingen, and nearly double the maximum fall of the river Elbe, traffic up river should be difficult and expensive, cannot be surprising, but that freight charge for such goods as coal, ores, stone etc., should be lighter than that of the railways, is certainly an undesirable state of affairs. Unfortunately the traffic up river is nearly double that down stream. In 1877 about one million tons of goods came down the Rhône to Marseilles, while nearly two million tons went up.

River regulations were proposed, the principal object of which was to reduce, by establishing a lowest mean water level of 5 ft., 3 in.,—the freight to be about two-thirds so that it might compare favorably with that charged on the northern watercourses of France, and be cheaper than railway freights. In most other French rivers and canals, the lowest water level is 6 ft., 6 in., but the low water of 5 ft., 3 in., in the Rhône is likely to occur only on very rare occasions; the water stood 6 ft., 6 in., only on seventeen days in the year, and is generally considerably higher; thus lowest water level is not considered an important drawback. River towage is contemplated after the completion of the Rhône regulations, and it is hoped that a useful and cheap water course may thus be established.

In 1865 it was decided that the river regulation works of the Rhône should be carried out by the Public Works Department, and should consist principally of river walls and embankments, inclosing the river on both sides so as to form a channel, which at Lyons commenced with 650 ft. in width, gradually increasing until at and below Arles it reached the respectable width of 1,300 ft. The height of these walls was fixed to be 6 ft. 6 in. above low water level, increasing to 10 ft. at Arles. Curves on the concave side of the river were not to be less than 1,000 yards radius. Very considerable amounts of money were spent in carrying out this scheme, but although it improved the general conditions of the river, it did not nearly fulfil expectations, and did not appear to repay the great trouble and outlay, a result which it is not difficult to realize, when it is considered that between the smallest and the greatest amount of water in the River Rhône near Lyons, the proportion is 1 to 29, while below Arles it is as much as 1 to 35, not taking into account exceptional floods.

In some places the result of the river regulation works carried out according to the plan of 1865 was a very unsatisfactory one, forming sandbanks and rapids at places where they had previously not existed, and this result was particularly noticeable near Lyons, where, at the junction of the Saône with the Rhône at Mulatière, some extensive weirs became necessary to raise the water level in the upper Saône. These weirs form the subject of our illustrations on pages 172 and 173, and we shall presently return to them to describe them in detail. In 1878 M. Jacquet, chief engineer at Lyons, proposed an altered scheme for the Rhône regulations, based upon observations extending over a considerable time, and which the lowest water levels were taken into account instead of, as before, mean water levels. In this new scheme, the width and height of the river walls is arranged in such a mannner that the speed of the water never exceeds a speed at which the shingle and coarse gravel forming the river bed is not materially affected. The general particulars of the new scheme are: Width of river bed near Lyons from 420 ft. to 490 ft., increasing in width at Arles to 820 ft., and below Arles to 1,300 ft. Height of wall 5 ft. above low water level, curves as before. M. Jacquet's new river regulation is at present being actively pushed forward, the construction of the river walls is let out to contractors, who have to provide limestone in blocks of not less than 130 lbs. and not more than 880 lbs.; to work and place them for 2s. to 2s. 6d. per cubic yard. The limestone is found along the banks of the Rhône in great quantities and excellent quality. The weirs near La Mulatière have recently been completed, and one, as far as experience shows, is very satisfactory. The conditions of the two rivers, the Rhône and the Saône, are very different, requiring special arrangements of weirs. The Rhône has a strong fall, rapidly changing its water level, and it carries large quantities of heavy bottom ballast. The Saône, on the contrary, has only a slight fall, the changes of level are slow, and it carries naturally but little heavy deposit. It occurs sometimes that both rivers have high water at the same time, but more often the two rivers do not rise simultaneously. As will be seen from our illustrations, Fig. 1, the Saône is almost entirely closed by two valves, an overshot weir built in the direction of the river and a weir with hinged shutters nearly at right angles to the former. A lock completes the Rhône regulations of La Mulatière.

Both weirs are movable in the widest sense of the word, since they are not only fitted with movable slides, but can be completely laid down in the river bed when the state of the floods make it desirable to do so. The weir *A B*, which ordinarily acts as an overshot, is 330 ft. long; a general sec-

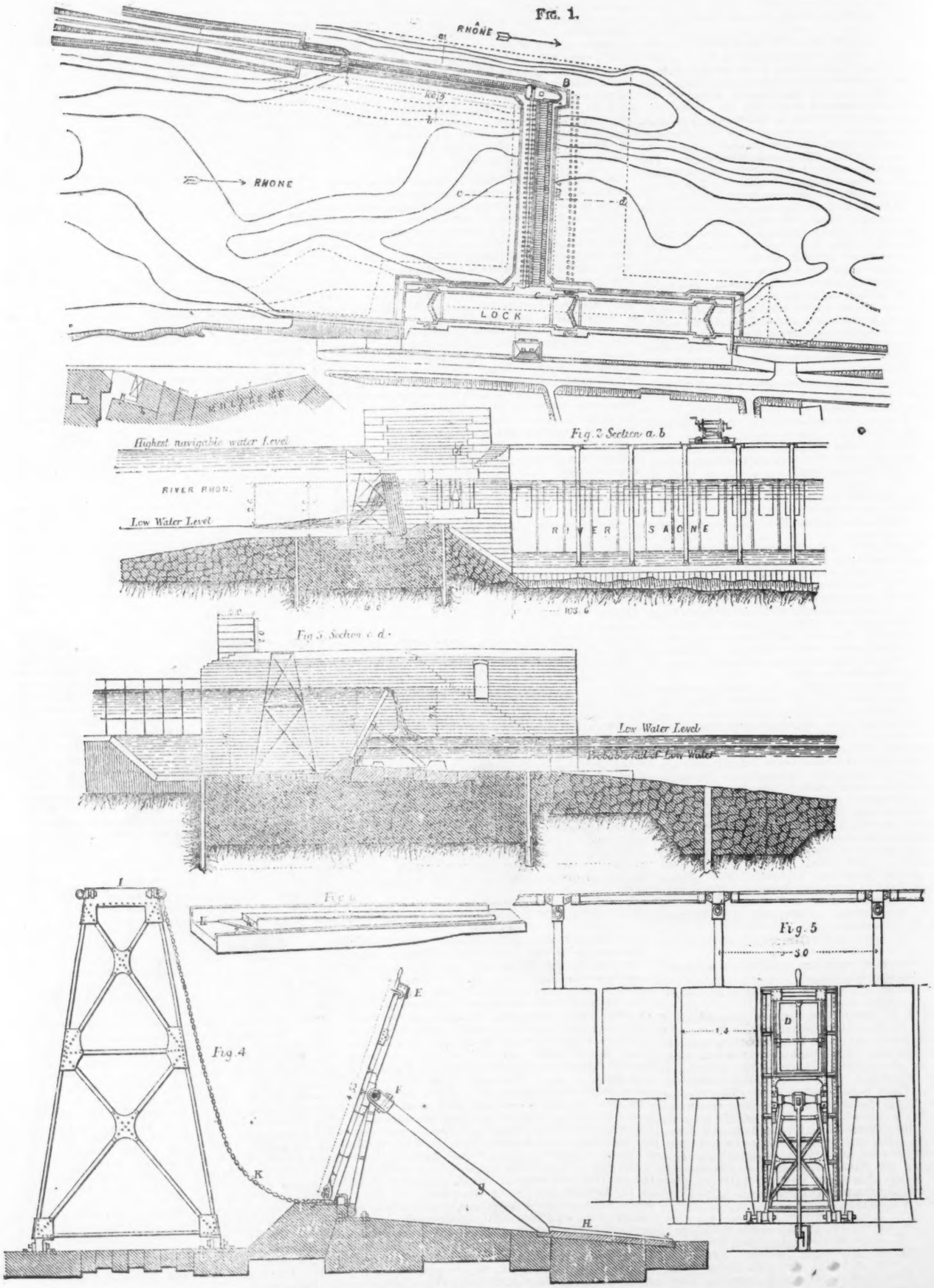
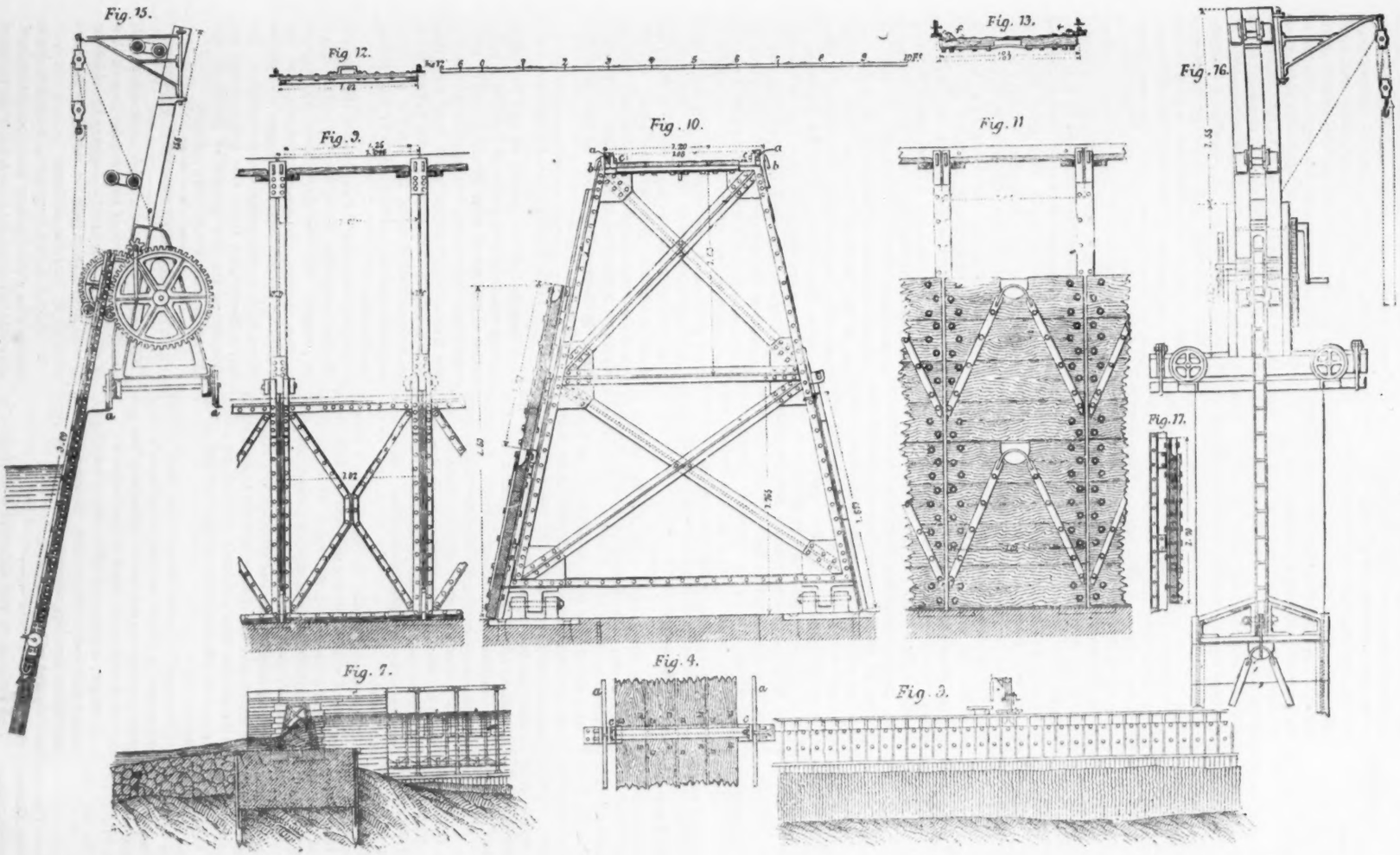


Fig. 1.

Fig. 2. Section a. b

Fig. 3. Section c. d.

Movable Weir on the River Rhone at la Mulatiere, near Lyons.



tion is shown in Fig. 2, while Figs 7 to 16, on page 173, show details of this work, from which it will be seen that it consists mainly of wrought-iron framed trestles placed 3 ft. 6 in. apart, and fitted on their front side with two rows of wood shutters, which can be raised and lowered by means of the hand winch with rack and pinion motion, shown in Figs. 15 and 16. This hand winch travels on rails *a a*, see Figs. 4 and 14, fixed by means of the bolts *b b* to angle brackets *c c*. When necessary, the shutters are raised up, lifted out of their guides, placed on small trucks (see Fig. 8), running also on the rails *a a*, and stored in the depot at the end of the weir. On the right-hand side of the trestle in Fig. 10, and in elevation in Fig. 9, iron-hinged doors are shown, which open automatically to let the water of the Saône flow into the Rhône, but close to prevent flow of water in the opposite direction, which would be likely to carry dirt and deposit of all kinds into the weir. At times of drift ice, the trestles, hinged at the bottom, as shown in Fig. 10, are laid down flat, after the top platform and rails are removed. When only slight rises in the River Saône take place, this weir *A B* acts, as already mentioned, as an over-shot weir, if a steady rise takes place; at first the sluices *D* of the weir *B C* (see Fig. 5) are opened, next follow the slides in weir *A B*, and not until high water occurs, resource is had to the arrangement of laying down the hinged shutters of weir *B C*. The construction of this weir will be readily understood on reference to Figs. 4, 5, and 6. The movable shutters *E*, 14 ft. 3 in. high, and 4 ft. 7 in. wide, made entirely of iron, are pivoted at their center at *F*, and by means of a windlass travelling on the platform *I*, the chain *K* is wound up and brings the shutter *E* over the horizontal position, until it rests upon the strut *g*. If the chain is now still further wound up, the strut is withdrawn from its position against the lug *h*, and drops down against the inclined edge *i*. The chain is not slackened, the strut *g* slides off sideways on the edge *i*, and strut and shutter are laid flat on the bottom of the masonry. Figs. 4 and 5 also show that the wrought-iron standards *L* and their longitudinal connections *M*, carrying the platform *I*, are hinged, and during the time of drift ice on very high water, can be lowered and laid flat, when a perfectly clear watercourse is established, and vessels pass over the weir.

Steam winches are now being used for lowering and lifting the various parts of this weir, which was designed by M. Pasquean, engineer, of Lyons. We acknowledge with pleasure our indebtedness for the above information, and the drawings belonging thereto, to our valuable contemporary the *Zietschrift für Bauwesen*, Berlin, in which some more detailed information on the regulation of French rivers will be found.—*Engineering*.

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NOTICES OF MEETINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS,
SECRETARY'S OFFICE.

The next meeting of the Institute will be held at Roanoke, Virginia, during the first week in June. A detailed programme of sessions and excursions will be issued early next month. Members are requested to send to the Secretary as soon as possible, the titles of the papers they intend to present at this meeting.

Easton, Pa., April 2, 1883. T. M. Drown, Secretary.

American Society of Civil Engineers.—The annual Convention of this year will be held at St. Paul and Minneapolis, Minn., beginning June 19, 1883. Full arrangements will soon be announced.

It is also proposed to make special provision for a visit to the Exposition of Railway Appliances, at Chicago, before proceeding to St. Paul and Minneapolis.

John Bogart, Secretary.

April 5, 1883.

The Union Water Meter Co., of Worcester, Mass., has recently issued a neat illustrated catalogue and price list of the line of hydraulic material in which they deal. The noticeable feature in it is a series of practical and useful tables, relating to the use and measurement of water, which are included among the contents of the catalogue; the authorities are given in each case, and they are the best.

The St. Paul Convention A. S. C. E.—The meetings will be held in St. Paul on Wednesday, Thursday and Friday, June 20, 21 and 22. On Saturday, the President will deliver the annual address in Minneapolis. A banquet will be given by the local engineers on Saturday evening at the Hotel Lafayette, Lake Minnetonka. Gen. Bishop, D. C. Shepard and William Crooks of St. Paul, and William S. King, C. F. Hatch, and C. H. Prior of Minneapolis, will represent the local engineers of the two cities upon a reception committee. The St. Paul and Minneapolis Chambers of Commerce have each appointed three of its members to act with the above named gentlemen, so that the reception committee will consist of nine members. The usual hotel and railroad courtesies will be extended to the visiting members. There will be excursions to various points, and as this is the first convention held in the Northwest, the probability is that it will be a very pleasing one for all who take part in it.

Tests of Materials at the Chicago Exposition.—The committee on tests, of which General Wm. Sooy Smith is chairman, have issued a circular to the Civil, Mechanical, Hydraulic and Mining Engineers of North America, inviting their attention to the proposed series of tests of the strength and quality of materials used in general construction, which tests are to be made at the coming Exposition at Chicago (May 24 to June 23).

The committee wish these tests to be complete as possible, and they request visiting engineers to bring with them specimens of any useful substance for this purpose which they can obtain; they also solicit suggestions from engineers or others which may promote the efficiency of these tests. When completed the results are to be published, and the circular gives full details as to the form in which the different materials are to be submitted.

The committee who have this matter in charge includes some of the strongest names in the engineering profession and we feel assured that they will do their part well; we trust that they may have all the assistance for which they ask. Every engineer and manufacturer in the country is vitally interested in the results of these and similar experiments.

The Hendon Local Board, near London, are still undetermined as to the best process for purifying the sewage of their town. A few months ago we gave an extract of a report on the subject by Mr. Hancock, President of the Board. A supplement has recently appeared giving interviews with Mr. Sillar, inventor of the A. B. C. (Alum, Blood and Charcoal) process, Mr. Hanson, inventor of the "Hanson" process, and Mr. Melliss, engineer to the Rivers Purification Association. Mr. Sillar said that for Hendon, with a population of 10,000, the works could be put up for $30,000, and the annual cost to the town for treating the sewage would be $2,500. His company would dispose of the sludge.

Mr. Hanson stated that there were 57 different systems for treating sewage before the public. He uses lime and black ash (refuse from alkali works) and would require three acres of land. The cost of the works would be $10,000, and the annual expense for treatment would be $2,000.

Mr. Melliss, in advocating the alumina process, thought no better purification could be obtained at a less expense than by this method. The cost of the works would be about $15,000 and the purchase of five acres of land. He could not give the annual cost of purifying the sewage without making an examination.

Applied Mechanics. Part I. By Henry T. Bovey, Professor in McGill University, Montreal. 1888.

Part II. of this work, which treats of frames, roofs and bridges, was published some months ago and duly noticed in our columns. Part I., which has just appeared, treats of the strength and elasticity of materials, of beams, columns, shafts, hollow cylinders and spheres. Numerous problems are introduced to exercise the ingenuity of the reader, and many of them require a much better knowledge of the principles of elementary mechanics than it is usual for students of technical schools to have. The following are four of these problems:

A hammer weighing 10 lbs. strikes a blow of ten foot-lbs. and drives a nail half an inch into a piece of timber; find the speed with which the hammer moves and the mean resistance to entry.

A chain l feet in length and a square inches in sectional area has one end attached to a weight of W lbs. at rest and at the other end is a weight of w lbs. moving with a velocity of v feet per second away from the first; find the greatest pull on the chain.

Two equal carriage wheels, with their centers connected by a rigid bar, are placed upon a rough plane; is the equilibrium of the system best preserved by rocking the hind or front wheels?

A weight is placed on an ordinary rectangular table which rests on the ground; calculate the pressure on the four legs, supposing the legs to be rigid as compared with the ground.

Proceedings of the Michigan Association of Surveyors and Civil Engineers.—The growth of an intelligent and active practical interest in their profession by the Civil Engineers and Surveyors of Michigan is well illustrated by this, the latest report of the above society. But a couple of years ago the meagre proceedings of the annual meeting were published in a half dozen pages, and gave but little information of value to anybody; the volume before us is a bulky pamphlet of 124 octavo pages, which, besides giving the proceedings of the fourth annual meeting held at Lansing in January last, is crammed full of most valuable and practical information for the profession, represented. The first eighteen pages are taken up with the lists of officers and members, the constitution and by-laws, reports of annual meeting and treasurer's report. The rest of the volume is made up of papers read at the meeting, of which the following is the list: Legislative Needs of Surveyors, by Geo. E. Steele, of Grand Traverse; The North Lansing Mill Dam, by A. D. Bartholomew, of Lansing; Wooden Pavements, by H. G. Rothwell, of E. Saginaw; Water as a Source of Engineering Difficulty—a good servant but a poor master—by Professor Chas. E. Greene, Mich. University, Ann Arbor; Common Roads, by Burton Kent, Adrian, Mich.; Difficulties in City Surveying, by A. J. Teed, Cadillac; Logging Railroads, by E. F. Guild, E. Saginaw; Practical Questions, arranged and answered by I. H. Leavenworth. Saginaw; Necessary Instruments for Surveyors, by J. B. Davis, Ann Arbor; Surveying for Railroads, by F. Hodgman, Climax; Projection of a Parallel of Latitude, by H. C. Pearson, Ferrysburg; Traverse Surveying, by J. B. Davis, Ann Arbor; Engineering of Town and County Drains, by S. N. Beden, Pine Run; Report of Committee on Instruments; A Level Line of Sight, by J. B. Davis, Univ. of Mich., Ann Arbor; Variation of the Needle; Table of Declinations for 1883; The Judicial Functions of Surveyors, by Justice Cooley, of the Michigan Supreme Court, reprinted from Proceedings of 1881. The volume is edited by Prof. Chas. E Greene, of the University of Michigan, and is printed in good type on excellent paper. We are tempted to reprint some of the papers, but the low price at which the whole collection may be had is a sufficient reason for giving the association the whole benefit accruing from their publication. We expect it will have a large sale, especially among surveyors. The price is only *thirty cents*, postpaid, which is really less than the volume cost the association. For fifty cents the Proceedings of last year and this can be had. Address communications to Professor Chas. E. Greene, Ann Arbor, or Prof. R. C. Carpenter, Lansing, Mich.

THE BROOKLYN BRIDGE.

A meeting of the trustees of the East River Bridge was held in Brooklyn on April 9. A requisition of $166,666.66 from Brooklyn, and of $233,333.34 from New York, was reported favorably by the Executive Committee as the final large sums to be required. The arches are yet to be fitted up as fire-proof warehouses, and some of the members anticipate an annual revenue of $50,000 from their rental.

Mayor Low moved the adoption of the report of the Toll Committee, fixing five cents as the rate to be charged. This recommendation was opposed by Gen. Slocum, who favored two-cent tolls; and a motion from the latter gentleman to refer the report back to the committee was adopted. Ex-Mayor Howell said that a free bridge would add $469,350 to the tax budget of Brooklyn, and $312,500 to that of New York annually.

FRAUDULENT SURVEYS IN CALIFORNIA.

The San Francisco *Chronicle* of March 30 calls attention to an abuse of the "Special Deposit" law of 1879, and an apparent conspiracy by which the general government pays for surveys of lands not taken up by bona-fide settlers.

The special deposit system was devised to assist settlers who wished to have their lines determined, and could not await the long delay that the use of government survey appropriation would entail. By the provisions of this act such a settler could petition the Surveyor-General of the district to have the township in which he resided surveyed

on depositing a sufficient sum of money to cover the expenses of the survey. The settler received a "Certificate of Deposit," which was recognized as so much paid on the purchase price of the land. Originally these certificates were neither transferable or negotiable, but by an amendment to the original act they became both, and thus opened the door to the fraud charged.

It now seems that applications are made by bogus settlers in collusion with land surveyors. The deposits are made with the sworn applications, but the "certificate" covering the deposit can be at once conveyed into land transactions any where in the State. In the meantime the surveyor does his work and is paid by the government in the belief that the land is actually settled up as sworn to in the application. The wide discrepancy between "deposits" made, and land actually sold has at last aroused suspicion and investigation.

THE HUDSON RIVER TUNNEL.

Work has been resumed within the past week on the New York end; the water is now pumped out, and preparations are being made for pushing forward the tunnel, which at this time is just fairly through the pile-work supporting the head of the Christopher street dock. On the Hoboken side, no further advance has as yet been made. The compressors are going, keeping the tunnel free from water as has been the case since the temporary stoppage last January. Something over 1,600 lin. ft. of the tunnel was completed at that time from the west shore.

Mr. Chas. G. Francklyn, who succeeded the late Mr. Trenor W. Park as President of the company, was for a long time agent of the Cunard line of steamers in this city, and is now better known as a capitalist of very abundant means, energetic and likely to push forward to success any scheme in which he is interested; he is still in Europe, but expects to return shortly. Mr. D. G. Haskins, the original projector of this bold engineering undertaking, is still the chief executive and manager, with about the same engineering staff as was associated with him last January.

As this tunnel ranks among the most prominent engineering works of the day, and embodies features that are novel and of great interest to the profession, we mean to keep ourselves and our readers thoroughly posted as to its progress and the methods employed. The possibilities opened up by the success of the application of compressed air to a horizontal tunnel are great, and while doubt still exists among many engineers as to its ultimate feasibility, it is simply justice to give the projectors of this special work due credit for the advance already made, and the increased knowledge in the use of a comparatively new agent in constructive engineering, for which we are indebted to the trials and valuable experience gained in this particular undertaking. It is a new departure, and, as yet, elsewhere untried on any extensive scale; it is typically American in its conception, and, like all other digressions from the beaten professional path, it has had and will have its trials and failures, but we hope it will as well be finally crowned with success.

PROGRESS OF WORK ON THE BOSTON IMPROVED SEWERAGE.

From the annual report of H. M. Wightman, City Engineer of Boston, for the year 1882 we extract the following points of interest connected with the progress of the above undertaking. The filth-hoist, situated at the end of the main sewer, has been completed within the year. The two iron penstock gates, 7 ft. × 6½ ft. each, are in place, and being counterbalanced are worked by hydraulic pressure from the city mains, acting through cylinders and pistons. Behind each gate are a pair of screens or filth cages formed of vertical bars of iron with one-inch spaces, by which all solid matter likely to clog the pump-valves will be intercepted and can be removed, the cages being raised and lowered by steam power.

At the pumping station the coal-house is built and roofed in, the walls of the boiler-house are about finished and those of the engine-house will soon be started. The stone used is granite from the old Beacon Hill reservoir. Four steel boilers are in place, with feed pumps and salt water pumps. The boiler-house, with all its apparatus, may be said to be in running order.

The two Leavitt engines are in complete condition for service, the foundations for the Worthington engines and pumps are completed and these engines will be placed this year (1883.)

In the outfall sewer the sea wall at the outer end is completed, the main embankment is nearly finished, ballasted and rip-rapped, and about 800 ft. of the lower half of the tank sewers are in place.

In the tunnel portion of the work, the entire tunnel section is excavated throughout, and on Jan. 1, 1883, 1,994 lineal feet, or about 28 per cent. of the length, yet remained to be lined with brickwork, besides portions of two shafts. The maximum amount of water noted flowing into the tunnel was about 64,000 gallons per hour; this is now decreased to 52,000 gallons, owing, probably, to silting up of some of the crevices in the rock. No inconvenience is expected from the presence of this water when the tunnel is in use, as the head of the sewage inside the tunnel will be in excess of that of the water outside, and no leakage inward can occur. A large mining pump will be provided at the east shaft, so that the tunnel can be cleared of water at any future time, should it prove necessary.

The outfall sewer to Moon Island and the reservoir was relet, Dec. 28, 1881, to C. W. Parker & Co., and the work has been prosecuted with vigor since; 844 feet of the outfall sewer on Squantum Neck has been finished. The embankment from Squantum to Moon Island is partly constructed and protected by rip-rap.

On Moon Island two low discharge sewers are nearly completed, also an outfall chamber, turbine well, engine, boiler and coal-house foundations. The easterly wall of the sewage reservoir is finished, and the northerly wall nearly so. The value of the work done at this point during the past year is, in round numbers, $250,000.

CROES' STATISTICAL TABLES OF WATER-WORKS.

Whatever Mr. Croes undertakes to do receives his unremitting care and attention. He will have it right if it is possible to get it so. When he undertook to publish the pamphlet of statistics above mentioned, he did not know as much about the labor involved in it as he does now. Neither did we know what labor, and annoyance, and cost was ahead of us when we settled our contract for price and time of completion. The first "proofs" scared the printer into throwing up the job, and it was only by concessions on our part that we got him fairly down to work. We have now already in the bindery nearly all the pages of statistics, and the advertisements are being set as fast as it is possible to do so. Mr. Croes has persisted in having everything done up to his standard of perfection and accuracy, and will get in everything possible up to the latest moment. Water-Works Statistics has become a "hobby" with him, and he is already a live encyclopedia of information on American Water Supply. This pamphlet —or book as it really is—is the *avant courier* of the larger treatise to follow a year or so hence, and every effort has been made to render it as valuable as possible for the interests represented. It cannot fail to be the "ready reference book" of water-works throughout the country for a long time to come. And not only for water-works, but to insurance, banking and similar investing corporations, who can there readily find the exact, or closely approximating condition of the water works of this continent at a glance.

The following well-known firms and individuals have recognized the value of being represented in the advertising pages of this valuable and unique publication:

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CINCINNATI AND NEWPORT IRON AND PIPE CO., Newport, Ky.
JAMES MARSHALL & CO., Pittsburgh, Pa.
A. H. MCNEAL, New Brunswick, N. J.
PANCOAST & ROGERS, New York City.
S. L. WILEY, Contractor, Greenfield, Mass.
J. EDWARDS & CO., New York City.
J. J. R. CROES, Civil Engineer, New York City.
R. HERING Sanitary Engineer, New York City.
D. MCN. STAUFFER, Civil Engineer, New York City.
THEODORE COOPER, Civil Engineer, New York City.

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ENGINEERING RECREATIONS AND REMARKS.

BOOK MAKING.—As long as the country continues in its present prosperous condition, we suppose that books will be continually multiplied. The pen is mightier than the sword, but two swords riveted together to form a pair of scissors enable a book to be made much more quickly than with a pen. But it is not alone in these latter days that this has been done. It has been always thus. That wonderful book, "Burton's Anatomy of Melancholy," consists largely of quotations, but all woven together with marvelous art. "Already," says he, "we have a vast chaos and confusion of books; we are oppressed with them; our eyes ache with reading, our fingers with turning." And he, to drive away melancholy, collected the cream from all this confusion and wrote one book more. The process still goes on, but there are few who do it so well as the ancient Burton.

ROBERT BURTON.—Born 1576 and died 1640, by profession was a clergyman, and also, says his biographer, "an exact mathematician, a curious calculator of nativities, a general read scholar, a

thorough paced philologist, and one that understood the surveying of lands well." He wrote nothing on mathematics or on surveying, and his only work was the "Anatomy of Melancholy," which, notwithstanding its mournful title, is a very readable and often a very funny book, even in these latter and degenerate days. Among his cures for melancholy, he highly recommends the practice of surveying and the study of mathematics. "What more pleasing studies can there be than the mathematicks theorick or practick parts? as to survey land, make maps, models, dials, etc., with which I was ever much delighted myself. Such is the excellency of these studies that all those ornaments and childish bubbles of wealth are not worthy to be compared to them." And again: "I would let him that is melancholy demonstrate a proposition in Euclide in his five last books, extract a square root, or studie algebra, than which, as Clavius holds, in all human disciplines nothing can be more excellent and pleasant, so abstruse and recondite, so bewitching, so miraculous, so ravishing, so easie withal, and full of delight, *omnem humanum captum superare videtur.*"

EDMUND GUNTER.—A fellow student of Burton's at Oxford was Edmund Gunter, who was also a divine according to the fashion of his times. He invented Gunter's chain, Gunter's scales, Gunter's line and Gunter's quadrant. He published a table of logarithms, a book on dials, and introduced the terms cosine and cotangent. Gunter's scale is now so rarely made that it is becoming a curiosity, but his chain still lives, and is extensively used, in spite of the awkward relation between links and inches. There is reason to believe that Gunter was the first to discover that the declination of the magnetic needle was not the same in different years. Gunter was born five years later than Burton and died fourteen years earlier. Burton's book has been through some nine or ten editions, and Gunter's chain has measured in this country many thousand miles of boundary lines.

STEEL TAPES.—The necessity for accurate measurements of lines in cities, bridge work, or mines, is gradually causing the abandonment of the chain with links, and the substitution of long steel tapes. They are made of a single piece of hoop skirt wire in lengths of from 200 to 1,000 feet, and by their use a great increase in the precision of linear measurements is attainable. The best way to graduate them is to put the zero point rather more than ten feet from one end, and from it to the remote end let a mark be put at every ten foot division, and from the zero to the short end let ten feet be graduated in the reverse order to feet, tenths and hundredths. By holding the proper ten foot division at one end of the line to be measured, the total distance can easily be read off as on an ordinary map scale. It is greatly to be desired that some maker would put these tapes on the market at reasonable prices, so that engineers may be able to purchase instead of undertaking the manufacture themselves.

STEEL THAT WILL NOT STRETCH.—*Mundus vult decipi* is an ancient saying, applicable even to the nineteenth century, and we fear even to the engineers and surveyors of it, judging by the talk whereby some instrument makers seek to sell their wares. For instance, in looking at the different styles of long tapes the other day, we were told by one manufacturer that his steel was a special tempered kind, which possessed the remarkable property that its stretch would be very slight for a tension less than sixteen pounds, and that no greater tension could possibly stretch it any further. This is certainly the kind of steel that we want, and it is surprising that such a remarkable property has remained unknown to experimenters on the strength of materials. What a grand subject for a paper, to be published in all the technical journals of the land—A newly-discovered steel, which no tension can elongate beyond a certain limit.

STRENGTH OF MATERIALS.—A great deal has been said lately about the necessity of experiments on the strength of materials to be conducted by the government. Huge beams and columns are to be furnished by the bridge companies, carried to Watertown at the public expense, broken in the machine, and the scrap then accounted for to the companies. Let us hope that some valuable conclusion may result from this singular procedure. Governmental investigations of this kind are proper and legitimate, if properly and legitimately conducted. There are many things yet to be learned about columns, of course, but the most valuable things are the general laws of resistance, and not the particular facts concerning the rupture of particular patterns. What important conclusions, for instance, can be derived from the fact that a certain kind of column of a certain length and diameter broke under a certain load, when we are ignorant of the fundamental properties of the iron of which it is made.

A CONUNDRUM IN COLUMNS.—The theory of columns is not yet so well understood as that of beams, although it has lately been wonderfully cleared up by the investigations of Prof. Robinson. The following is a conundrum for students by way of recreation: Let P be the load on a column with rounded ends, A its cross section, l its length, r the least radius of gyration of that cross section, and E the co-efficient of elasticity of the material. Then we have, as is proved in all the books, the well-known relation

$$\frac{P}{A} = \frac{9.87\,E\,r^2}{l^2}$$

Now the column shortens under the load an amount s, and the value of s is given by another well known formula, namely:

$$s = \frac{P\,l}{A\,E}$$

Multiply together these two equations and you will have the following result:

$$s = \frac{9.87\,r^2}{l}$$

which is remarkable and astonishing, for it shows that the shortening s is less for a long column than for a short one, something absurd and impossible. Now the conundrum is this: Why does this absurd conclusion arise from the combination of the two exact equations?

THE LARGEST LIGHT-HOUSE IN THE WORLD.—The Light-house Board is making preliminary arrangements for the construction of a light-house at Fourteen-Foot Bank, Delaware Bay, for which there is an appropriation of $175,000 available. This will be the largest structure of its kind in the world. Its erection will be attended by many difficulties, as the foundation will be laid in twenty-one feet of water and twelve miles from the mainland.

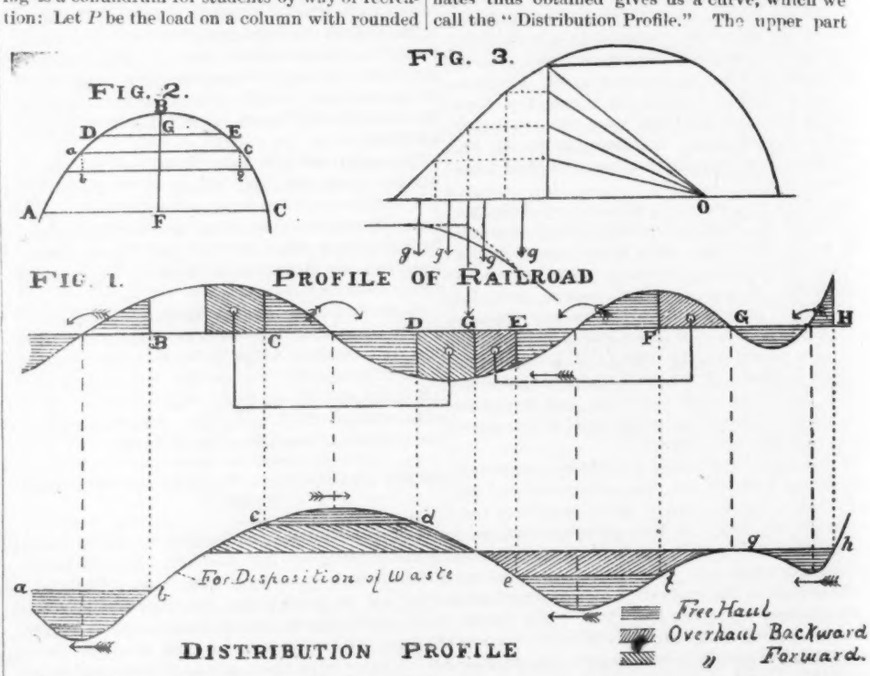
GRAPHICAL DETERMINATION OF THE DISTANCE OF HAUL.

BY E THIANGE, C. E.

This method of calculating the distance of haul is very generally used in Germany and gives a quick and accurate result, and is recommended especially for its simplicity and elegance of representation.

In Germany this method is known under the name of "Massenivellement," which, translated literally, means "Leveling of Masses."

The principle is as follows: We lay off on vertical ordinates in each station the quantity lying between this station and a certain starting point in the line chosen arbitrarily, *i. e.*, we add successively all the quantities and lay off on ordinates the summations at the points where they are made, observing that excavation and embankment are to be taken with opposite signs. Further excavated material which increases with loosening is to be augmented by this increase before being summated. A line through the limits of the ordinates thus obtained gives us a curve, which we call the "Distribution Profile." The upper part



of Fig. 1 represents an ordinary profile; the lower part represents the corresponding "Distribution Profile." Comparing these, we observe:

1. The grade points in the ordinary profile correspond with maximum and minimum points in the "distribution profile."

2. Excavation follows an ascending line, and embankment a descending line.

3. The difference between the lengths of two vertical ordinates represents the quantity lying between the points at which the ordinates are erected.

4. Between two points where the "distribution profile" is intersected by any horizontal line the excavation is equal to the embankment.

We can thus at a glance determine the points between which there will be neither borrow nor overhaul. But for each case there is but a single line which fulfills the condition of most economical distribution. It is not our intention to discuss this object fully, but only to apply it to the common practice of this country. In ordinary practice the limit of free haul is usually assumed as 1,000 ft. Everything beyond this point is paid for as overhaul, the question of most economical distribution not usually being fully considered.

We have now but to seek either side of the grade points, the stations lying at the specified distance apart between which excavation equals embankment. Observing rule 4, we can easily find these stations by tracing the lines *ab*, *cd*, *ef*, and *gh* equal or smaller than the distance of free

haul. Having thus determined the quantities of free haul, we have next to calculate the overhaul. Let Fig. 2 represent a part of a distribution profile. The line *D E* equal to the specified distance of free haul cuts off the excavation *D B*, embankment *B E*. The quantity is represented by the length *B G*. The second line *AC* determines the overhaul, *i. e.* the excavation *A D* moved to the embankment *EC*. The distance of overhaul is the distance of the center of gravity of these masses. Now the product of the excavation, multiplied by the distance its center of gravity is moved in making it into the embankment, is equal to the area *A D E C*. Let us consider an infinitesimal portion of our profile represented by *ab=eg*. The movement of haul of this portion is represented by the product *ab×ae* which is also the expression of the area *ab eg*. Now, if we enumerate the infinite small products, we obtain the total "movement of haul" equal to area *A D E C*. Hence, having our distribution profile and wishing to know the haul of any portion as *AD*, we measure with a planimeter the area *AD EC* and divide this area by the ordinate *G F* representing the moved quantity. The result will be the distance between the center of gravity.

If we wish to obtain the positions of the centers of gravity we can find these as is shown in Fig. 3, which will easily be understood by those who are acquainted with "Graphical Statics." The quantities in the distribution profile are considered as so many vertical forces, *g, g, g, g*, and for the pole *O*, is constructed the polygon of forces, which gives directly by the intersection of its extreme sides, the vertical G in which lies the center of gravity. In most cases this will, however, not be asked, as only the moment of haul for a distance of 100 feet is considered.

It will now be easy to understand Fig. 1, where the overhaul is figured for a part of a railroad profile, and the corresponding stations between which free haul and overhaul takes place are shown.

PERSONAL.

W. A. SOMERS is City Engineer of St. Paul, Minn.

EDWARD W. KINGSLEY resigned April 6 as a member of the Massachusetts Railroad Commission.

GEN. CHARLES P. STONE, of the Egyptian army, has been appointed engineer of the Bartholdi monument in New York harbor. He is now in Washington as the guest of Gen. Sherman.

COFFIN COLKET, President of the Philadelphia, Germantown & Morristown Railroad Company, died at Philadelphia, April 5, aged 74. Mr. COLKET was one of the pioneers in railroad construction in America.

MR. S. R. STIMSON has resigned the office of general superintendent of the Manitoba Railroad line. No successor will be appointed, the duties heretofore discharged by Mr. STIMSON being assumed by the General Manager.

J. D. COOK, of Toledo, O., one of the most prominent hydraulic engineers of America, has been spending a part of the week in this city. Mr. COOK is recently from Galveston, Texas, and Nashville, Tenn., for which cities he has been furnishing plans of water-works, of which we have already made mention.

MR. RICHARD J. EVANS, who is chief engineer of the new Memphis, Selma & Brunswick Railroad, has about twenty years' experience in charge of railroad construction and management in the South, principally in Louisiana and Texas. He was chief engineer of Morgan's Louisiana & Texas Railroad for several years. Just previous to his present engagement he had charge as chief engineer of the terminal works of the Texas & Pacific Railway at New Orleans.

LIST of civil and mechanical engineers in the employ of the New York Steam Company, 22 Cortlandt street, New York. WM. P. SHINN, Mem. A. Soc. C. E., Vice-President; CHARLES E. EMERY, Mem. A. Soc. C. E., Superintendent and Chief Engineer; EDWARD MARSLAND, M. A. Soc. C. E., Assistant Superintendent; H. W. BRINCKERHOFF, Assistant Engineer; THEO. PASCHKE, Assistant Engineer; E. A. RUDIGER, Assistant Engineer; J. B. WHITE, M. E., Assistant Engineer; E. E. MAGOVERN, M. E., Assistant Engineer; G. F. SIMPSON, C. E., Transitman; A. A. QUIGLEY, Rodman; EGBERT BENSON, Rodman; A. E. WATKINS, M. E., Draughtsman; WM. RUMBLE, Draughtsman; FRANK LIARD, Draughtsman; JOHN C. LEWIS, C. E.

ELECTIONS AND APPOINTMENTS.

J. B. AHRENBECK, was elected City Engineer of Hemstead, Texas, on the 5th.

A. H. EVANS has been appointed Acting Superintendent of the Nickel-Plate, vice E. E. Dwight, resigned.

JOHN W. SMITH has been appointed General Superintendent of the Silver City, Denver & Pacific Railroad.

JOHN A. GRANT, was elected Chief Engineer of the New Orleans, Baton Rouge, Vicksburg and Memphis R. R. on the 9th.

MR. H. C. LOWRIE was re-elected City Engineer of Denver, Col., on the 3d for a term of two years by a majority of 2,451. Mr. Lowrie ran 642 votes ahead of his ticket. This is the first election under a new city charter.

ERASTUS WIMAN was elected president of the Staten Island Railway Company April 3. He has chosen his own board of directors and made an alliance with the Iron Steamboat Company. This terminates a struggle which has continued for many years for the traffic of New York Bay.

UNITED STATES TRUST CO.—GEORGE BLISS, of MORTON, BLISS & CO.; WILLIAM LIBBEY, late of A. T. STEWART & Co., and JOHN CROSBY BROWN, of BROWN BROTHERS & Co., have been elected Trustees of the United States Trust Company, of New York, to fill vacancies created by the death of EDWIN D. MORGAN, ROBERT L. STEWART and WILLIAM E. DODGE.

SINALOA & DURANGO R. R. CO.—The annual meeting of the stockholders of this company was held at the office of the company, 40 Water street, Boston, on the 5th inst., when the following Board of Directors was elected: ROBERT R. LYMAN, D. B. SAFFORD, EDWARD P. NORTH, of New York City; JNO. G. STETSON, JAMES S. CUMSTON, S. W. RICHARDSON, and J. HENRY BROOKS, of Boston.

WABASH, ST. LOUIS & PACIFIC OFFICERS.—The new Board of Directors of the Wabash, St. Louis & Pacific Railway Company organized April 5 by electing the following officers: President, JAY GOULD; First Vice-President, R. S. HAYES; Second Vice-President, AMOS L. HOPKINS; Third Vice-President, H. M. HOXIE; Treasurer, E. S. H. SMITH; Assistant Treasurer, W. D. CORNEAX; Secretary, JAMES F. HOWE.

At the annual meeting of the stockholders of the King Iron Bridge and Manufacturing Company, Tuesday, the following board of directors were chosen: ZENAS KING, DAN. P. EELLS, L. ALCOTT, HENRY D. SIZER, C. B. BERNARD, HORACE WILKINS, JAMES A. KING, THOMAS H. BROOKS, and HARLEY B. GIBBS. The board organized by electing ZENAS KING, President, JAMES A. KING, Vice-President, and HARLEY B. GIBBS, Secretary.

CORRESPONDENCE.

UNCERTAIN DESCRIPTION OF LAND.

BLUEHILL, Me., April 10, 1883.

EDITOR ENGINEERING NEWS:

Referring to the communication of "D" in your issue of March 31, I cannot say how the Courts of other States would rule. But in this State, I think the Courts would hold that from the junction of White Oak Creek with Clear Fork the boundary must follow Clear Fork to the point in that stream which was *nearest* to the "double maple;" then by a *straight* line to the maple. A direct line from the junction of White Oak and Clear Fork to the maple would not answer the terms of the grant at all. Yours truly,

O. H. TRIPP.

TESTS OF IRON AND STEEL.

ORDNANCE OFFICE, WAR DEPARTMENT,
WASHINGTON, April 6, 1883.

EDITOR ENGINEERING NEWS:

SIR: Referring to the circular from this office of January 19, 1883, inclosing a programme of tests submitted by the American Society of Civil Engineers, I have now the honor to inform you that, Congress having failed to appropriate money for the purpose, it will be impossible for me to pay the freight charges on the material sent to Watertown Arsenal for test. I will, however, be glad to make tests if the material is sent there free of cost.

Very respectfully, your obedient servant,

S. V. BENET, Brig.-Gen., Chief of Ordnance.

THE OLDEST IRON RAILROAD BRIDGE.

CHATTANOOGA, Penn., April 10, 1883.

EDITOR ENGINEERING NEWS:

The article in your last issue on "The Oldest Iron Railroad Bridge," was of particular interest to me from the fact that while a student at the Rensselaer Polytechnic Institute, I made a drawing of the bridge mentioned, but at the time I did not know the exact age of the bridge, although it was evident that it had not been constructed recently.

As a matter of news, I will state that quite an important bridge is now in contemplation of erection across the Tennessee River at this place. It will consist of five spans of about 200 ft. each, and although to be used primarily as a highway bridge, will be so designed as to be used for a railway when necessary. The soundings and preliminary surveys for the work will be begun as soon as the river recedes sufficiently. Respectfully,

J. A. FAIRLEIGH.

UNCERTAIN DESCRIPTION OF LAND.

SOUTH WOODSTOCK, Conn., April 9, 1883.

EDITOR ENGINEERING NEWS:

In regard to the question raised by "D." in your issue of March 31, I hold that the first claim is the correct one, even aside from the admitted intention of the grant; or, to make the case more general, I will leave the hollow out of the question and give the opinion that the Clear Fork must be followed to the point where it comes *nearest* to the beginning, and then run in a straight line *to the beginning*.

My reasons are: first, The word "south" as ordinarily used by lawyers, means "southerly" when not in direct connection with that portion of a description giving courses and distances, and as the Clear Fork, both near the junction with White Oak and near the beginning, runs northerly, it follows that "south" with Clear Fork must mean *up* that stream.

2d. As you cannot follow Clear Fork to the beginning, you must come as near to it as possible, *i. e.* follow Clear Fork to the nearest point to the beginning, and then run *to the beginning*.

Yours, respectfully, C.

LOWTHORP'S TRUSS.

WASHINGTON, D. C., April 10, 1883.

EDITOR ENGINEERING NEWS:

I hardly know what to say to Mr. Lowthorp in answer to his letter published in ENGINEERING NEWS of March 31. If he had simply asked for information or explanation of what he could not comprehend, because of his defective memory, I would have referred him to the NEWS of March 10, 1883, page 120, which contains a brief but faithful account of his patent of June 30, 1857.

But no, he pounces upon the description of a patent in the NEWS of March 24, page 143, which is *not* his patent of June 30, 1857, and strenuously asserts that it fails utterly to describe this patent on that date.

But Mr. Lowthorp does not ask even for an explanation, though none is needed. The patent he speaks of has been described in its proper chronological order in a former number. He insists that the descriptions and drawing of an entirely distinct patent shall be made to describe his patent

of June 30, 1857, and because it does not do this, he casts an imputation upon the correctness and reliability of these articles on Truss Bridges.

The best thing about the whole matter, however, is that the description of the patent which occasions the ire of good Mr. Lowthorp, and which he says is an untrue account of his patent of June 30, 1857, is a description of a separate patent granted to him in November of the same year, and which it seems he has entirely forgotten. Perhaps the children of his brain are so numerous he has forgotten he is the father of some of them.

It only remains for Mr. Lowthorp to state whether the description he refers to is not a fair description of his patent of November, 1857, and that it is straining the English language too much to make it cover his patent of June 30, 1857.

Yours, F. B. BROCK.

WOOD PAVEMENT IN TEXAS.

DALLAS, Texas, April 7, 1883.

EDITOR ENGINEERING NEWS:

I inclose specifications of a bois d'arc wooden pavement such as I am putting down in this city, supposing such specifications would be of some interest to your readers.

This bois d'arc timber grows in the swamps of Texas in abundance, generally about ten inches in diameter and about 20 feet high, crooked, and with very little sap-wood.

It is as hard as lignum vitæ wood, of a light yellow color, and remains many years in the damp ground without decay.

The pavement now built is a success, combining endurance with freedom from noise and dust, and is cheaper than stone or asphalt, being put down at $2 per square yard, including excavation and graveling.

The bois d'arc timber can be bought delivered at $8 per cord, and gravel at $1 per cubic yard.

A pavement of this wood is said to have been used for forty years in Monterey, Mexico, and is still serviceable.

The resistance to abrasion and crushing of this wood is greater than almost any known timber.

As the wood does not decay in damp situations, no sanitary objections can be urged against it.

If you know of any one who would test its resistance to tensile or crushing force, I will send you suitable sample pieces. Respectfully,

W. M. JOHNSON, City Engineer.

BOIS D'ARC. SPECIFICATIONS FOR WOOD PAVEMENT ON ELM STREET, BETWEEN SYCAMORE AND MARKET, DALLAS, TEXAS.

Grading.—The road-bed to be properly graded to a sub-grade of twelve inches below the established grade of the street, and to conform to the cross-section of the street, as furnished by the City Engineer.

Before placing the ballast thereon, the road-bed shall be well rolled with a cylindrical roller, not less than five feet long, and to weigh not less than 5,000 pounds. The surplus earth excavated to be disposed of under the direction of the City Engineer; provided, no haul shall be greater than 1,000 feet.

Ballast.—A bed of bank sand and gravel, six inches deep, shall be placed upon the road-bed, as prepared above, and shall be evenly spread, and rounded to the shape of the street, and shall be well rolled with the roller specified above, so as to form a perfectly solid bed the entire width of the roadway.

Blocks.—Blocks to be stripped of bark, of cylindrical shape, and sawed at right angles to the axis of the blocks, out of good, sound, live bois d'arc timber, free from knots and other defects, shall be six inches long, and from three to eight inches in diameter.

Blocks must be placed on end, in a close, compact manner, care being taken to so arrange the larger and smaller blocks together, that the interstices between shall be left as small as possible, and no square holes found, and make all spaces, as near as possible, of uniform size. All blocks adjoining the curb to be split, and the flat side placed against the curb, so as to make light and even joints, each block to rest squarely upon its base, without binding. Before spaces between the blocks are filled with gravel, the blocks shall be pounded with a pounder weighing not less than eighty pounds, twelve inches in diameter, and flat on the bottom, and the blocks all brought to an even and uniform surface. No teaming shall be allowed over the pavement until the spaces are filled with gravel.

Spaces.—The spaces between the blocks to be filled with screened gravel, free from sand and dirt, and rammed in until solid with iron or steel bars, then covered and refilled, and swept off with a coarse broom; a hot composition of coal tar and pitch (such as is used for roofing purposes), and not less than one and one-fourth gallons per square yard shall be poured into and over the spaces. After an inspection by the Street Committee (if accepted), the whole surface shall be covered with gravel and sand to a depth of three-fourths of an inch.

Cross-Walks shall be made at all intersecting streets, ten feet wide, level with the center line of the street, and the ends to be on a level with the curb, and to be crowned two inches higher than the paving.

All the above work to be done in a good, sound and workmanlike manner, according to the directions of the City Engineer, and to be subject to the approval of the Committee on Streets and Bridges.

All material and labor and implements required on said work to be furnished by the contractor. The contractor to protect the street from travel, where the work is under way, and to take precautions to prevent all accidents, night and day, to teams and pedestrians. The excavation to be estimated per cubic yard, by the City Engineer, and all other work measured per square yard, and bids shall be based on the same.

The above is a true and correct copy of the specifications for Bois d'Arc Wooden Street Pavement, as presented by me, and accepted by the City Council of Dallas, Texas.

W. M. JOHNSON, City Engineer.

DALLAS, Texas, March 30, 1883.

NEWS OF THE WEEK.

THE DES MOINES, OSCEOLA & SOUTHERN NARROW GAUGE is to be extended 60 miles from Decatur City, Iowa, to St. Joe, Mo. this summer, as soon as contracts can be let.

THE TELESCOPE FOR THE PULKOWA OBSERVATORY.—Messrs. Alvin Clark & Sons of Cambridgeport, have just completed for the Pulkowa (Russia) Observatory the largest and the best reflecting telescope in the world. The object-glass is thirty inches in diameter, the tube is forty-five feet in length and forty inches in diameter.

THE MANITOBA SOUTHWESTERN RAILWAY will be opened to the boundary line on the 15th inst., and as the Northern Pacific is in readiness to run regular trains over the line of the new route to be established, the Southwestern will be the principal rail communication with the States. A company is applying for an act of incorporation of the Winnipeg & Rosseau Railway, with power to construct a line from Winnipeg to within twelve miles of the boundary in Southern Manitoba. A radical change will be effected in the working of the Canadian Pacific construction. The North American Contracting Company, composed solely of Montreal capitalists, was formed some months ago, and entered into a contract with a syndicate to carry on the work of construction companies, such as Langdon, Sheppard & Co., and Manning, McDonald & Co., but is itself responsible to the syndicate for the performance of the work. The road, when constructed, will be turned over to a syndicate in sections. As the constructing company is composed of the best and wealthiest capitalists in Montreal, this relieves the railway company of a great deal of trouble and responsibility. One of the changes the contract involves is the transfer of engineers in the department of the Canadian Pacific Railroad to the control of the North American Company.

PENNSYLVANIA COAL MINES.—Pennsylvania has 339 anthracite coal mines, employing 80,589 persons, which in 1882 were worked an average of 227 days and produced 29,298,784 tons, with $32,740,942 paid in wages. The number of bituminous collieries is 442, employing 40,136 hands, and in 1882 they produced 20,694,110 tons, with $18,775,553 paid in wages.

NEW WATER-WORKS.—After a good deal of discussion and some legal difficulties, Hamilton, Ohio, is in a fair way to have some contracts to build water-works soon to let. Troy, O., and Wabash, O., are ready to let contracts, and so is Galveston, Tex. J. D. Cook, the well-known hydraulic engineer of Toledo, O., is consulting engineer of these enterprises.

NEW WATER-WORKS.—Attleboro, East Weymouth, Wellesley, North Adams, and Franklin, Mass., are petitioning for a public water supply.

PIPE CONTRACTS LET.—The contract for water pipe for the new works at Adrian, Mich., has been made with the Cincinnati and Newport Iron and Pipe Co.

PROPOSED TUNNEL UNDER NIAGARA RIVER.—BUFFALO, April 1.—A petition signed by a large number of capitalists of this city was to-day presented to the Common Council, asking that the right of way be granted to build a tunnel under Niagara River, the city to receive 25 per cent. of the profits of the same when completed.

NEW RAILROADS.—Two important new lines of railway are now being surveyed in East Tennessee, which will prove of very great value in the development in this part of the State. One is to extend from Sparta, over Cumberland Mountain, to the Cincinnati Southern Railway, near Rugby, and the other to extend from the Cincinnati Southern Railway, near Sunbright, to Knoxville.

EXTENSION OF THE HANNIBAL & ST. JOSEPH R. R.—Messrs. Gould, Sage, Bloodgood and other principal stockholders decided March 30 to build the proposed extension from Quincy to Chicago. It is proposed to issue bonds and stock on the new road at the rate of $25,000 per mile.

NEW STREET-SWEEPING CONTRACT.—Articles of incorporation of the Woodbury Street-Sweeping Machine Company have been filed with the County Clerk of San Francisco. The purpose of the company, as stated in the petition, "is to manufacture, build, sell, buy and repair street-sweeping machinery; to bid for and enter into public and private contracts for the sweeping of streets; to purchase, sell and deliver street sweepings and fertilizers; to lease, sell, assign and transfer, and to contract for the leasing and sale, assignment and transfer of rights, exclusive or otherwise, to use the patent right vested in and granted to George E. Woodbury by letters patent of the United States, issued March 20, 1883." The directors are George E. Woodbury, Andrew M. Haines, J. H. Sayre, W. W. Knott and William Alexander. The capital stock is placed at $250,000, of which $249,600 has been taken by Mr. Woodbury, and the remaining $400 by the other members of the company in equal shares.

TYLER (TEX.) WATER-WORKS.—A heavy rain on the night of the 5th destroyed the dam of the city water-works, but the city suffers no loss, as the agreement with the contractors was that they should be responsible until the entire system was completed and turned over to the city. Mr. Brown, the contractor, has a large force at work putting it in order again.

FIRE ENGINE PURCHASE.—Santa Barbara, Cal., on the 2d, voted by a two-thirds majority of one, to buy a fire engine at a cost of $4,000.

N. Y. WATER SUPPLY.—The scheme for supplying New York and the Hudson River towns, with water taken from Lake George or thereabouts and conveyed in an aqueduct has been favorably reported to the Senate. Capital of the company is $50,000,000.

BROOKLYN WATER SUPPLY.—Preparations for increasing the water supply of Brooklyn are progressing.

SOUTHINGTON, (CT.,) WATER SUPPLY.—Surveys are being made for a public water supply.

IRON MILLS SHUTTING DOWN.—The Reading Iron Works will close the sheet mill at the foot of Spruce street and the rolling mill at the foot of Seventh street at the end of this week. This will throw between four and five hundred men out of work. It is not known how long the suspension will last, but it has been learned that the mills will not be started again until the company's business is more active. The pipe-mill of the iron works which has, been running on full time, stopped work Thursday morning, though the finishing department is still working. The two Butwell furnaces pulled bars on Tuesday and the four Lapwell and Turnup furnaces pulled bars Thursday morning. There are sixteen men employed at each Lapwell furnace each turn. Next week the mill will resume, but will run three days and three nights only, and so continue until further notice.

FRAUDULENT.—The Post-office Department has declared the Portable Electric Light Company, of No. 22 Water street, Boston, to be engaged in conducting a scheme to defraud the public, and the Postmaster in that city has been directed to discontinue the delivery to that firm of money orders and registered packages.

CONTRACT AWARDED.—Keller & Bush, of Lancaster, have contracted for the grading of the Harrisburg & Gettysburg Railroad, and will begin work early next week and finish by Sept. 15.

MIDDLETOWN (DEL.) WATER-WORKS.—Waterworks and a fire-engine house are soon to be erected at Middletown, Del.

NEW RAILROADS.—It is expected that before the close of the present year four new lines of railway will be built through Clinton County, Pa.

THE PANAMA CANAL.—Capt. Nathan Appleton, of Boston, the American agent for De Lesseps, has just returned from Panama, and reports as follows: 5,000 to 6,000 men are at work, mainly Jamaica negroes. At present the working hours are from 6 A. M. to 11 A. M. and from 1 P. M. to 6 P. M. Mount Culebra, 300 feet above the sea level and 15 miles from Panama, is the principal point of attack. Mr. Albert Millet has the contract for removing 4,000,000 cubic yards of material from the top of this hill, and will soon have in operation 10

or 20 excavators built in the United States, at the Pacific end, some three miles above Panama. An American has the contract for dredging and has commenced work. At the Atlantic terminus two dredges, with a capacity of 1,300 cubic yards per day, are at work. These machines were built in Belgium, and are similar to those used at Suez; they are preparing the way for the three colossal dredges built by the Slaven Bros. (described in ENGINEERING NEWS, Feb. 3) in Philadelphia. These gentlemen have formed a company called the American Constructing & Dredging Company, and have already a very large contract. One of their dredges is now about 800 miles on its way to the Isthmus.

Lieut. Rogers, of the United States Navy, who has just returned from a personal examination of the works, drawings and plans of the Panama enterprise, draws the following conclusions (as reported by the New York *Herald*):

"That the preliminary work of fixing and clearing the route, of erecting docks, quarters, machine shops, machinery, rolling stock, etc., and the accumulation of material and personnel has been so far advanced that the work of excavation will be vigorously begun by the beginning of the next dry season.

"That the work of excavation has already been begun at two points on the line.

"That the increase of means of transportation, which has heretofore been insufficient, and the completion of machinery now on the isthmus, will soon enable this work to advance rapidly.

"That there can no longer be doubt as to the intention of the company to carry out the proposed plan of this canal. The date fixed by M. De Lesseps for its completion is 1888, and the present superior agent, Captain Richier, is sanguine that this will be accomplished. He also believes that the canal can be made for the amount estimated, 600,000,000 francs. But I infer from conversation with canal engineers, and with others well versed in affairs, that the canal will not be finished for some years later, and that the cost will largely exceed the estimate. And it seems probable that this will undergo the experience of many other great projects—that the original subscribers must again subscribe or lose their venture, and that new stockholders will be the ones to share the profits. Up to the present date about 130,000,000 francs have been expended. In this amount the cost of all machinery, ordered or received, is included, as well as the purchase of property. The cost of the Panama Railway, believed to be about $17,000,000, however, is not included in this amount, special arrangements having been made for its purchase."

THE DELAWARE SHIP CANAL.—WILMINGTON, April 6.—Details are published here this afternoon concerning the operations of the Maryland and Delaware Ship Canal Company, which was formed for the purpose of constructing a ship canal across the peninsula, by what is known as the Sassafras route. It is stated that the bonds have been placed in France by Mr. Henry B. Tibbitts, of New York, the President of the company, and that the money has been raised for the canal, which is to cost $8,000,000. The canal, it is said, will be constructed within the next four years. Estimates of cost and specifications of the work for the use of contractors have just been issued.

A PROSPECTIVE BRADFORD CO. (PENNA.) R. R.—It is expected that a narrow-gauge railroad will be built between Troy, Bradford County, and Wellsboro, Tioga County, during the summer.

PHILADELPHIA WATER DEPARTMENT.—A new water committee of Councils organized on Tuesday afternoon. Chairman Cuming stated that there was an urgent necessity for the improvement of the water supply, and the Chief Engineer was entitled to the co-operation of the committee. He said that $600,000 was expended annually in maintaining the department, from which the income was $1,500,000. The standing committees were appointed by the chair, and it was decided to hold the meetings hereafter at the Water Department.

PRICES OF TILES FOR 1883.—The tile makers of Northwestern Ohio met in convention at Lima, last week, and effected an organization. They reported the following schedule of prices for the coming season: 2½-in. tile, $12 per 1,000; 3-in., $15 per 1,000; 4-in., $23 per 1,000; 5-in., $26 per 1,000; 6-in., $35 per 1,000; 7-in., $47 per $1,000; 8-in., $60 per 1,000; 9-in., $75 per 1,000; 11-in., $110 per 1,000; 12-in.. $150 per 1,000.

DES MOINES WATER-WORKS.—DES MOINES, Iowa, April 10.—The council this evening, at the close of a lengthy and animated session, passed a resolution declaring the charter of the Des Moines Water-Works company forfeited. The contest between the company and the city has been a long one, the trouble first arising several years ago. By the terms of the charter the company was entitled to receive from the city the annual sum of $27,250 for fire protection. The length of the company's mains is twenty miles, and there are 196 fire hydrants. For more than a year, it is alleged, there has been an inadequate supply of water, and this was for a large portion of the time unfit for consumption. Members of the council claimed this was a violation of the charter which gave the council the right to declare it forfeited. This argument was used to secure from the water company more reasonable rates. The water company finally offered to reduce the amount to $20,000 annually. The company's works are bonded for $300,000, and it is claimed stock to the amount of $450,000 more has been issued. The bonds are mostly owned in Cleveland, O.

PANAMA R. R. ELECTION.—At the annual election of the Panama Railroad Company, the following directors were elected to serve for the ensuing year: J. G. McCullough, R. W. Thompson, Jesse Seligman, E. P. Fabri, J. W. Ellis, Theo. J. De Sabia, D. O. Mills, C. G. Francklyn, Joseph Ogden, William B. Dinsmore, Thomas Maddock, George Garr, E. F. Winslow; 69,000 out of 70,000 votes were cast for the above ticket. The only change in the directory is the election of Gen. Winslow to fill the vacancy caused by the death of Trenor W. Park. The annual statement of the company shows: Gross earnings, $2,096,633; miscellaneous receipts, $357,741; total, $2,454,374. Total operating expenses, fixed charges, $1,371,810; net earnings, $1,082,564. The treasurer's statement shows assets, made up of cash in bank, bills receivable, and miscellaneous, $4,326,929, and sundry liabilities amounting to $3,512,987, leaving a surplus of $813,941. Dividends paid during 1882, 12½ per cent.

THE INDIANAPOLIS NEW STATE-HOUSE.—The board of State-House commissioners, as a preliminary movement to reletting the contract for the construction of the building, are about to declare the existing contract with Howard & Denig annulled, as the work detailed for March was not performed, and nothing is now being done, with the exception of a little work by a sub-contractor, who is carrying out a small contract let to him last fall. The commissioners think that it will require at least four months to settle the questions incident to the letting of the new contract.

THE TAY (ONT.) CANAL.—This is a small canal to be made by deepening the River Tay between Rideau Lake and the town of Perth, Ont. The Dominion Government has appropriated $75,000 for it, to be expended in 1883-84. It is doubtful if it will ever be built, as the main purpose of it is to furnish an excuse to spend some money among the doubtful voters of the riding in which it is located.

NATIONAL RAILWAY EXPOSITION ITEMS.—One of the older railways of this country will send to the Railway Exposition a section of "T" rail which has been in continuous use from 1838 to the present year. It is intended to accompany it with statistics showing the total tonnage which had passed over it during its forty-five years of service, and also a history of its experiences during that period.

The same railway will claim to enter the "oldest railroad man in the United States"—that is, the man who has seen the longest term of continuous railway service. His railway life began several years previous to that of the rail mentioned above. What stories he can tell about railroading in the early days!

The Association of Railroad Telegraph Superintendents has changed the date of its next annual meeting in Chicago from the first Wednesday in May to Wednesday, June 13, so that its members may be able to visit the National Exposition of Railway Appliances, which will be in progress at that time.

THE BIRMINGHAM (ENG.) R. R. STATION.—Operations have commenced by which, at a cost of $1,250,000, New street station, Birmingham, Eng., will be converted into the largest railway depot in the world. It will cover a total area of 45,000 square yards, or over eleven acres, and will have three platforms, each 1,000 ft. long.

HONDURAS INTEROCEANIC RAILWAY.—A contract has been made with J. J. Waterbury and J. L. Hance, of New York, granting them a privilege of 99 years for the construction of a railway across Honduras, from the bay of Honduras to Fonseca Bay. Work was to be begun by March 1, and the line finished in five years.

THE HARLEM SHIP CANAL.—Gen. W. F. Smith, W. R. Grace and James D. Fish, commissioners for appraising damages, etc., upon the line of the canal, have filed their report. They appraise at $148,000 the land wanted, and assess the land at $260,000, the difference to pay all expenses, legal and otherwise, connected with the appraisement and assessment. The canal is to be 400 ft. wide, 15 ft. deep at low tide, and to run from the North River to the East River, cutting across the Dyckman property and the site of the rolling mills at Spuyten Duyvil.

THE FREE-PIPE BILL PASSED BY THE PENNSYLVANIA SENATE.—HARRISBURG, Pa., April 6.—The free-pipe bill, which has been before the legislature for fifteen years, was to-day passed finally in the Senate by a vote of 31 to 12. This bill gives the right of eminent domain to companies chartered for the transportation of oil through pipe lines. The passage of this measure has always been resisted by the Standard Oil Company, and until this year the Pennsylvania Railroad Company has used its powerful influence in defeating it. As the Standard Oil Company transports nearly all its oil through pipe-lines, the Pennsylvania Railroad Company has thrown no obstacles in the way of the passage of the bill, while F. B. Gowen, the President of the Philadelphia & Reading Railroad Company, wrote a letter to Senator Emery indorsing the bill. The only real opposition to it came from farmers in the eastern portion of the State, many of whom are said to have signed remonstrances against its passage in the interest of the Standard Oil Company, which is opposed to a free-pipe line bill because it would compel the corporation to transport oil at reasonable rates to avoid competition. The bill which passed the Senate to-day will receive even a larger vote, relatively, in the house.

ATLANTIC & PACIFIC R. R.—Advices from the front state that the track is now laid seven miles west of Kingman and only 38 miles from the Colorado River, where connection is to be made with the Southern Pacific. Tracklaying is progressing at the rate of two miles a day, and it is expected that the connection will be made by May 1. The central division of the Atlantic and Pacific is now completed to Tulsa, Indian Territory, and Chief Engineer Thomes is arranging for a bridge across the Arkansas River at that point and the establishment of stock yards four miles beyond. A temporary bridge 1,500 feet long will be erected, to be completed by the 15th of May, but an iron bridge will be built for permanent use. This bridge will shorten the Texas cattle drives about 200 miles, as heretofore the stock had to be driven up to the Kansas border before it could reach the railroad, and it will also give the stockmen of the Indian Territory west of the Arkansas River shipping facilities never before possessed. The St. Louis and San Francisco Railroad expects to bring at least 1,500 car-loads of stock to St. Louis from Tulsa the coming season and by the completion of the road to that point will be able to transport freight to the Osage, Pawnee and Sac and Fox Indian Agencies and to Okmulgee and other points in the Creek nation. It is expected that the road will be extended to Fort Reno, 150 miles west of Tulsa this summer.

SOUTH EVANSTON (ILL.) WATER-WORKS.—The time for receiving bids is extended to May 1.

THE DULUTH AND NORTHWESTERN RAILROAD COMPANY, a new corporation, has organized to build a railroad from Duluth, starting in Minnesota at a point on the ship canal, thence along the Bay of Superior to Rice's Point, northwesterly to the northern boundary line of the State, with one or more branches to the western line of the State. The capital stock is put at $2,000,000, divided into 20,000 shares. The corporation will go into effect on April 10, and the proposed road will have something of the same route as that surveyed by the proposed Duluth and Winnipeg road. One branch of the line, if built, will probably go to Grand Forks.

THE CIVIL ENGINEERS.—The chamber of commerce and board of trade of St. Paul, have appointed committees to provide for the entertainment of members of the American Society of Civil Engineers, which meets in that city June 20, 21, and 22.

NEW BRAKE.—A new patent brake in an experiment at New Haven, on the 9th, stopped a 228-ton train going at a speed of twenty-five to thirty miles an hour on a level grade, in forty seconds, or 235 yards.

THE FARGO ARTIFICIAL STONE COMPANY ask to be released from the contract to put in the Fargo sewers.

CONTRACT AWARDED.—The contract for constructing the proposed marine hospital at Memphis has been awarded to John Reed, of Memphis, for $38,775.

WINNIPEG & HUDSON BAY RAILROAD.—At Winnipeg, Gen. Rosser, the newly-appointed Chief Engineer of the Winnipeg & Hudson Bay Railroad, was asked regarding the prospects of the construction and other matters. He says the consolidation of the above road with the Nelson River Company will greatly strengthen the company and render the construction a settled thing. The country has already been examined, and surveys will be commenced when the bill providing for the consolidation is passed by the government. The company has a party of engineers at Hudson Bay, who have been engaged during the past few months in exploring the mouths of Nelson and Hayes rivers, with a view of securing a good harbor. The line is to run within fifteen miles of Nelson River, where an excellent harbor has been found. Hayes and Nelson rivers converge and empty into the bay at the same spot and form a small bay, which is the harbor referred to. The entrance at Nelson River is deep, and a better harbor could not be desired. The company intends employing a large party and exploring the

straits during the summer and will use the York factory boats for that purpose. It has decided, if it can obtain the consent of the government, to send several engineers along with the expedition to explore the straits this summer.

HYDE PARK (ILL.), CONTRACTS.—The contract with Michael Clarkson for laying a vitrified 12-inch tile-pipe sewer on Woodlawn avenue at $2.69 per lineal foot was accepted. A contract with Dolese & Shepard for laying the water-main from the works to South Chicago at the rate of 85 cents per foot was approved.

CANADA PACIFIC R. R.—From Manitoba comes the news that railway construction east of Prince Arthur's Landing is going on steadily. Seventeen miles have been already graded. The telegraph line will be built to Nepigon as soon as the frost is out of the ground. One thousand surveyors will be placed in the field immediately in 100 parties of ten men each, to work in the railway belt between Qu'Appelle Valley and the Rocky Mountains.

A NEW HYDRANT.—The Patent Double-acting Syphon-Condensing Duplex-Masticating and Supreme Grandissimo Hydrant is the name; an official of one of the large cities is the patentee; but the hydrant is not yet adopted.

N. Y.. B. & W. S. R. R.—This road will be open to Schenectady by the 1st of June and to Buffalo by the 15th of July. The road is 17 miles shorter than the New York Central, has no grades over 30 feet, while the New York Central has to overcome grades of 86 feet. Eighty per cent. of the whole road is a straight line. The line is double-tracked, with 67-pound steel rails. It has better terminal facilities than any other road, and its equipment will be as perfect as the Pullman Palace Car Company is able to make it.

A NEW MARYLAND RAILWAY.—B. S. Randolph, C. E., is making a survey for a road to run from Blue Ridge Summit, on the Western Maryland R. R., to Berlin, on the B. & O. R. R., through the Middletown Valley.

THE PHILADELPHIA CABLE ROAD IN OPERATION.—The Union Passenger Railway Co. opened its new cable road on April 5; nine cars were propeled at a speed of seven miles per hour. The Union Co. is said to have carried 33,000,000 people in 1882. The cab to which the other cars were fastened is modeled after a special design, and is unlike the cabs used in San Francisco or Chicago. Under the bottom of the car a perpendicular piece of iron descends, and at the bottom a mouth-piece is attached, through which the cable runs. From the front part of the cab the engineer is able, by means of a wheel, to open the mouth-piece, or clasp, when he wishes to stop the cars, and grasp the cable again when he wishes to put the train in motion. The difference between these cabs and those of the companies in other cities consists in the fact that the engineer is encased in a glass partition, which shuts him off from all communication with the passengers and enables him to devote his whole attention to the route. The speed attained yesterday was at the rate of seven miles an hour, which enabled the trains to go over the route, a distance of a mile and three-quarters, in fifteen minutes—a little faster than a car drawn by horses would make the trip. The running of the cars was attended by little noise, and the easy and graceful manner in which the stops and starts were made and sharp curves at the Park end were turned elicited many complimentary remarks. Two or three horses which were passed along the route were scared by the trains skimming along without any apparent motive power, but the opinion was generally expressed that if the cars were attended by so little noise animals would soon become accustomed them.

The construction of the cable line was begun May 25, 1882, under the direction of George Rice, who is to remain chief engineer of the Union Line's cable motor. There are 2,500,000 pounds of iron buried in the street. The two engines supplying the power for moving the cables have a capacity of one hundred horse-power each. The driving gear is a duplicate of that employed in Chicago. The rope is an endless piece, 9,200 feet long, and is composed of crucible steel. Ten cars, with the brake attachment, have been built for the line. The cables without the cars require about fifteen horse-power to run them, and one set are supposed to last a year.

TIME.—The General Railroad Convention met at St. Louis, with a very large attendance. P. P. Wright, of Cleveland, occupied the chair, and W. T. Allen, of Philadelphia, acted as secretary. The present officers were continued another year. The present through time schedule was readopted. It was resolved that the following changes made in standard time go into effect on May 13: Roads east of and adjacent to Washington shall run by seventy-fifth meridian, or Eastern time; between these points and Kansas City they shall run by ninetieth meridian, or central time, or one hour slower than Eastern time; and west of Kansas City by one hundred and fifth and one hundred and twenty-fifth meridian, or Western time, two and three hours slower, respectively, than Eastern time. A committee was appointed to report at the next meeting on a uniform signal system. The convention adjourned to meet in Chicago October 12.

R. R. SURVEY.—An engineering corps will start out during the present week to examine the condition of the Petroleum Railway from Cambridge to Erie, the work already done and the work remaining to be done to complete the portion of the road between these places.

UNDERGROUND WIRES IN NEW YORK.—The Board of Aldermen, by a vote of 19 to 5, have passed the measure granting permission to the electric lines companies to lay their wires under the streets of this city.

ABOLISHING THE CONTRACT SYSTEM.—HARRISBURG, April 10.—The house to-day passed a bill abolishing the contract system in prisons and reformatory institutions.

NEW BRIDGE.—The Massachusetts Legislature has reported a bill to authorize the town of Winthrop to build a bridge across tidewater in said town.

PALMER (MASS.) WATER CO.—The bill to incorporate this company was tabled in the Legislature this week. It will probably pass later on.

TAYLOR (TEX.) WATER-WORKS are completed.

TELEPHONIC.—J. I. Sabin, President of the Sacramento Telephone Company, used a Western Union wire last Sunday afternoon to carry on a conversation with San Francisco. The route was by San Jose to San Francisco, thence across the bay by cable to Martinez, 170 miles. The operators at Oakland, San Francisco and Martinez all joined in the conversation. The voices, tones and words were distinctly audible.

SUBMERGED PIPE LAYING.—M. Walker has contracted with the Port Huron, Mich., Gas Company to lay a 10-in. main across Black River. The main will be placed three feet below the bed of the river and work will be commenced in June. Mr. Walker also has a contract to lay a main across Tittabawassee River at Midland.

THE LA GRANGE BRIDGE COMPANY was chartered on the 7th, to cross Colorado River (Tex.), above Buckner Creek; capital stock, $50,000; incorporators, J. C. Brown, W. H. Ledbetter, A. T. Bradshaw, J. B. Carter, R. T. Bradshaw, John Schumaker, W. S. Robson, A. Hadusek, B. T. Dunn, J. C. Steepel.

THE CHAPMAN VALVE COMPANY will have their new iron foundry at Indian Orchard built within two months. It will stand directly behind the main factory and be 150 feet long by 60 wide, with an L 100 by 30, and sand-sheds 100 by 15. The structure will require about 2,000,000 bricks and work will begin at once.

SEWER CONTRACT LET.—The contract for Boston's outfall sewer at Moon Island is given to Boynton Bros. at $102,397. There were lower bidders, but they could not give satisfactory guaranties.

A NEW ROLLING MILL is in course of construction at Toledo, Ohio, by a company known as the Maumee Rolling Mill Co., with $500,000 capital. H. S. Walbridge is the president; I. Droege, vice-president and general manager; H. S. Worthington, treasurer; E. H. Van Hoesen, secretary. They expect to be in operation by the end of the year. The capacity will be 100 tons. The main building will be 362×100 ft, with 40 feet of shed on either side. Other buildings are the foundry, 60×54 ft.; the machine shop, 64×32 ft., two stories; and the office, 44×35 ft., two stories.

NEW RAILROAD PROJECT.—Mr. P. P. Dandridge, chief engineer of the proposed railway from Pittsburgh to Lynchburg, Va., in the James River valley, has examined the regions to be traversed, and has submitted his report to those interested. He reports five different routes: From Pittsburgh via Tygart's Valley and Greenbrier Rivers and White Suphur Springs, 390 miles; from Pittsburgh via Tygart's Valley River and Covington, 375 miles; from Pittsburgh via Cheat River, Jackson's River and Covington, 370 miles; from Pittsburgh via Cheat River, Cow Pasture River and Williamson's, 342 miles; from Pittsburgh via Cheat River, Cow Pasture River, Panther Gap and Lexington, 306 miles. The shortest railway connection now in operation between Pittsburgh and Lynchburg is about 514 miles. Mr. Daindridge, after making the examination, recommends the route by way of Cheat River and Lexington, Va. The cost of its construction would be, it is thought, about $30,000 or 35,000 per mile. The engineer says that by this route the great lines of railway from the east to the west are crossed at the nearest practicable points at which they can be reached by a southerly road from Pittsburgh. It will touch two important lines of projected railway, which will prove valuable feeders when completed, and which are not approached by either of the other routes. It will cross the Baltimore & Ohio R. R. at Rowlesburg, 105 miles out from Pittsburgh; the Chesapeake & Ohio R. R. near Goshen depot, about 240 miles out, will intersect with the Valley R. R. of Virginia, now under course of construction at Lexington, Va., 255 miles from Pittsburgh, and by its connection with the Richmond & Allegheny R. R., will reach the Shenandoah Valley R. R., now being built to pass a few miles east of Lexington.

THE LONGEST IRON BRIDGE IN THE COUNTRY.—Work on the bridge over the Monongahela River at Homestead is progressing rapidly and satisfactorily. The bridge, when completed, will be the longest iron structure in the country, the entire length being over one mile. The south approach, on the side of the river on which Homestead is situated, is 400 feet long, while the north approach is 3 600 feet. Those who have seen the structure pronounce it to be a handsome piece of workmanship.

The new bridge on the Pittsburgh, Youghiogheny and McKeesport Railroad, over the Youghiogheny River, has been completed.

The bridge to be constructed over the Youghiogheny at Broadford, on the Baltimore & Ohio road, will be used for the passage of trains and for wagons, cattle and foot passengers, the trains passing above that portion used for wagons. The Keystone Bridge Company, of this city, has secured the contract. The specifications call for a bridge 30 per cent. stronger than those now used by the Pittsburgh & Lake Erie road, which, when built, were constructed at standard strength. The proposed bridge will consist of five spans, each 120 feet in length. Near Broadford a bridge is also to be built over the Baltimore & Ohio road and the Mount Pleasant branch of the same line.—*Pittsburgh Dispatch.*

IMPROVEMENTS AT LONG BRANCH.—The new stone jetty recently erected at the Highlands by the New Jersey Southern Railway Company is a success, and additional ones are to be built at once. A large force of men has been engaged, and the road-bed is to be rebuilt from Sandy Hook to Long Branch and relaid with steel rails. The station and docks at Sandy Hook are being rebuilt. The improvement will be completed before the opening of the summer season, when the three steamers, St. John, City of Richmond and Jesse Hoyt, will run between New York and Sandy Hook. There will be eight fast trains each way daily over the road during the summer season.

N. P. R. R. TUNNELS.—General A. Anderson, chief engineer of the Northern Pacific road, gives the lengths of tunnels on that line as follows: At the Big Horn 1,100 feet, through Bozeman Pass 3,600 feet, at the Mullen Pass, near Helena, 3,650 feet, at the Mullen grade 500 feet, at the Black Foot 500 feet, aggregating 9,350 feet.

IRON AND STEEL MARKETS.

PITTSBURGH, APRIL 11, 1883.

Notwithstanding all reports to the contrary, the ore question is still unsettled, and furnace companies refuse to place season contracts. Private advices from Cleveland to-day seem to indicate a probable weakening on the part of ore consumers. $8 is offered and $8.50 is asked. Production of pig iron is full, and nearly all of the 1,000 puddling furnaces are working double time. Foundry Iron is moving at $22@$24, and Forge at $19@$22, according to quality. Inferior irons are offered at very low prices. Muck Bars are selling at $33@$34; Merchant Bar shaded at 2c. in large lots, and a large amount of business has been transacted at these figures. The nail factories are working full time, and manufacturers are regaining the trade taken from them by Eastern makers. Quotations are $3@$3.20. Skelp Iron is in active demand. Plate and Construction Iron has been ordered in large lots. Representatives of the manufacturers and workingmen will confer in a few days to determine wages for the coming year.

WHEELING, APRIL 10, 1883.

All the West Virginia mills are well supplied with orders for thirty days, but beyond this consumers are afraid to go. The demand for nails is quite active at the present reduction.

CINCINNATI, APRIL 10, 1883.

The mills of this district are working along quietly, with a few orders in hand. The supply of Charcoal Iron is abundant, and large transactions have been closed at concession for delivery during the summer and fall. No labor troubles are anticipated. Offers are being made to obtain more favorable rates on freight on Alabama and Tennessee iron.

CHICAGO, APRIL 11, 1883.

The iron trade of the Northwest has developed some signs of improvement in Merchant Bar, Construction Iron and in hardware, both light and heavy. Prices are weak and stimulate demand. Inquiries are numerous and business is improving. Nails are in active request at the late reduction. Orders are to hand for steel rails in Illinois mills for large lots for summer and fall delivery.

PHILADELPHIA, APRIL 12, 1883.

The iron trade is not improving as much as brokers predicted, and business has been conducted at concessions on last week's quotations. Good mill brands are selling at $20@$21, delivered; Foundry at $22.50@$24.50. Inquiries are arriving from bridge and railroad builders, for summer delivery, and specifications are in hand for large supplies. Angle Iron is 2.50c.; Tees, 3@3.25c.; Channels and Beams, 3.25@3.50c. Pennsylvania has taken orders for Steel Rails under $39, and there are inquiries now in hand for a month's production. Old Rails have advanced to $25 for Tees and $28 for Double-Heads; Scrap is active at $25@$28; Spiegeleisen is held at $32.50; Bessemer Pig, $22.50; Muck Bars are $36; Merchant Bars, 2@2.35c.